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THE OTTAWA RIVER DAM.

One of the largest dams, if not the largest, in the world was built recently by the Canadian Government on the Ottawa River, about forty miles above Montreal, at a place called Carillon, and at the head of the rapids of the same name. The rapids are two miles long, with a fall of ten feet. The contract for this work, and a large slide which forms a part of it, was awarded to Messrs. F. McNamee & Co., of Montreal, in 1879, and was completed in 1881.

The plans of the dam and slide were made by Mr. Horace Merrill, of Ottawa, an engineer of the Department of Railways and Canals, one of the best and most experienced builders of dams and slides in the Dominion. The work was superintended by Mr. Merrill, assisted by his son, H. B. Merrill, at present a resident of this city, and to whom we are indebted for this information. To Mr. A. G. Nish, a member of the firm above mentioned, is due in a great measure the successful completion of the work.

The dam was built to raise the level of the Ottawa River to supply a new canal constructed at the same time, and as it closed several channels in the rapids, through which the greater portion of the square timber cut on the upper Ottawa and its tributaries passed, it necessitated the building of a slide 600 feet long by 28 feet wide for its passage. The magnitude of this work will be comprehended when it is understood that where the dam was built the river is 1,800 feet wide, with a depth ranging from 2 to 19 feet, and a current of 9 miles an hour; the bottom of the river being very uneven. The levels of the river were taken by Mr. Andrew Bell, resident engineer at Carillon, under whose supervision the canal was constructed. The dam was built on a foundation of narrow piers from 36 to 46 feet long, with spaces between carried to the bottom, but where the depth was too great they were built solidly from the bottom up for a short distance. The up stream ends of the piers were sheeted with 4-inch plank. The piers were built up to one level, and covered with 12 x 12 inch timber, making a platform across the river from 36 to 46 feet wide, the spaces between the piers allowing the surplus water to pass through. Upon this platform the flat dam, Fig. 1, was erected, the rear portion of the platform being first covered with 10-inch tamarack. The dam was also covered with 10-inch tamarack, and its crest protected by half inch boiler plate; 113 gates were made of timber 10 inches thick, and fastened to the sloping side of the dam with large wooden hinges, B, to cover the spaces between the piers, and they were all successfully closed the afternoon of November 9, 1881.

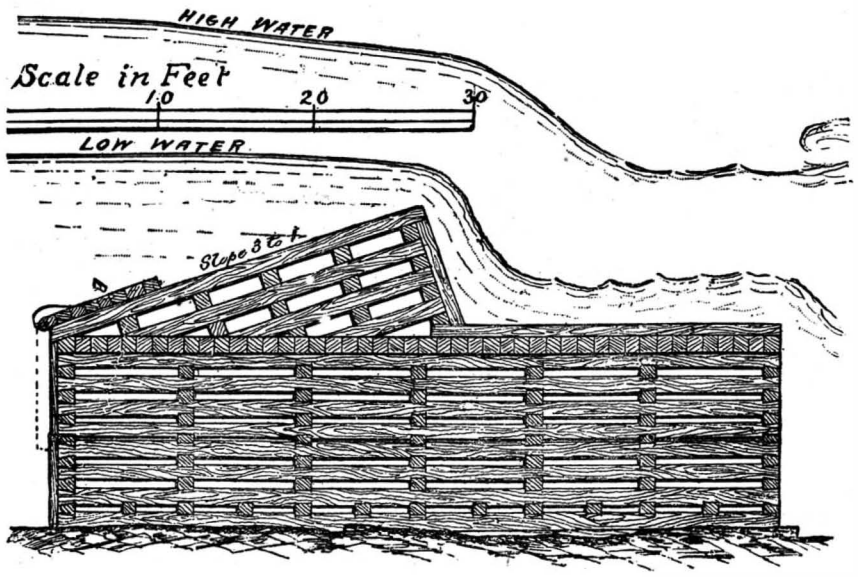
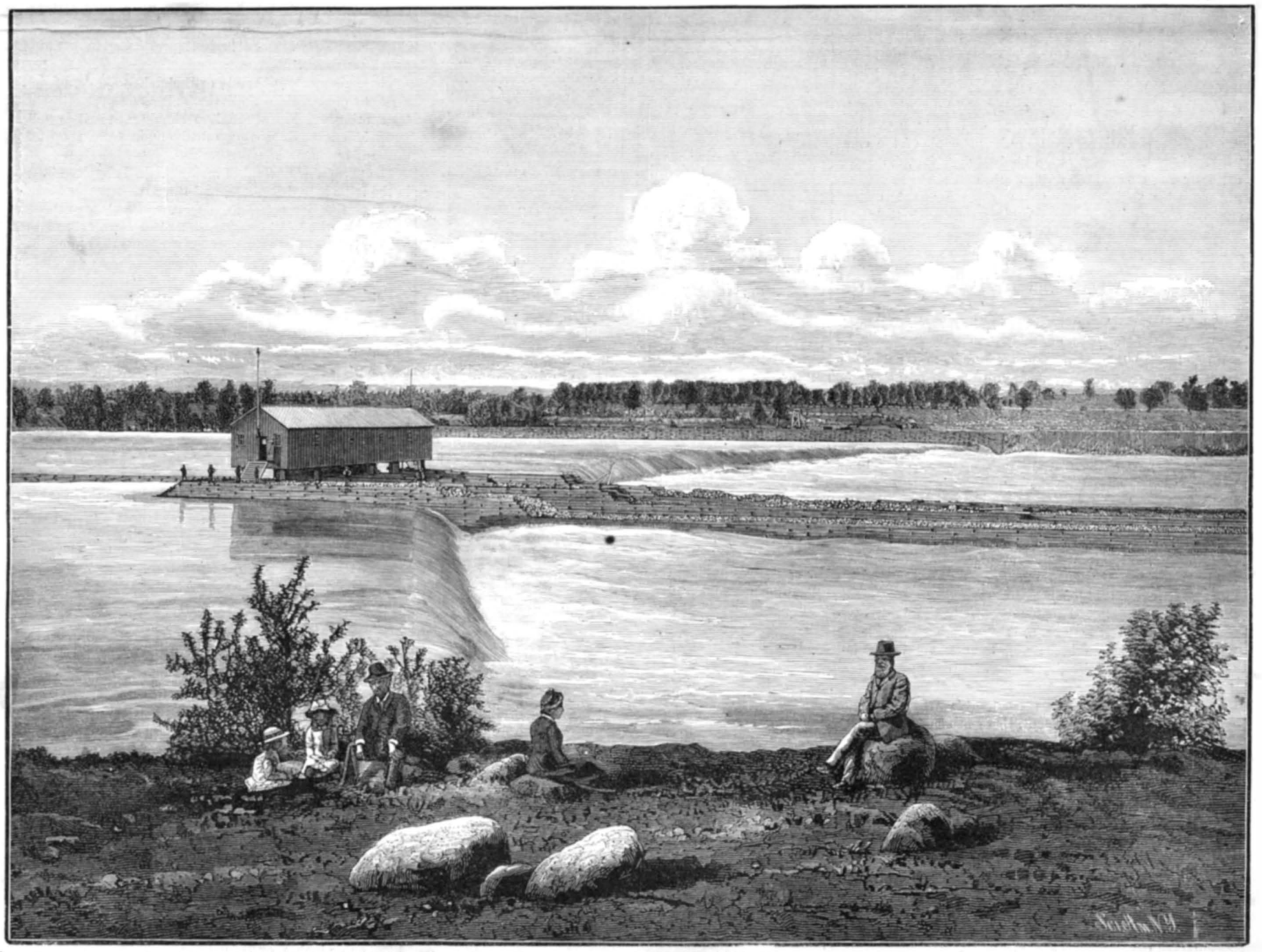


FIG. 1. CROSS SECTION IN DEEP WATER.

The foundation piers were securely bolted to the rock, and well filled with stone, as was also the dam. The level of the river was raised 8 feet, the depth of the water on the crest of the dam being 2 feet in low water, in high water 10 feet. To complete the above work a temporary dam had to be constructed above it to break the force of the current, an undertaking equally as difficult as that of the permanent work.

The slide has two guide booms, each 2 feet 6 inches deep by 3 feet wide, and nearly half a mile long, supported by large piers; it is provided with stop logs at its head to control the supply of water. A crib of timber will pass through the slide (600 feet) in about one minute.

The quantities of materials in the different portions of the work, and the cost, are as follows, viz.:



THE GREAT DAM ACROSS THE OTTAWA RIVER CANADA.—FROM A PHOTOGRAPH.

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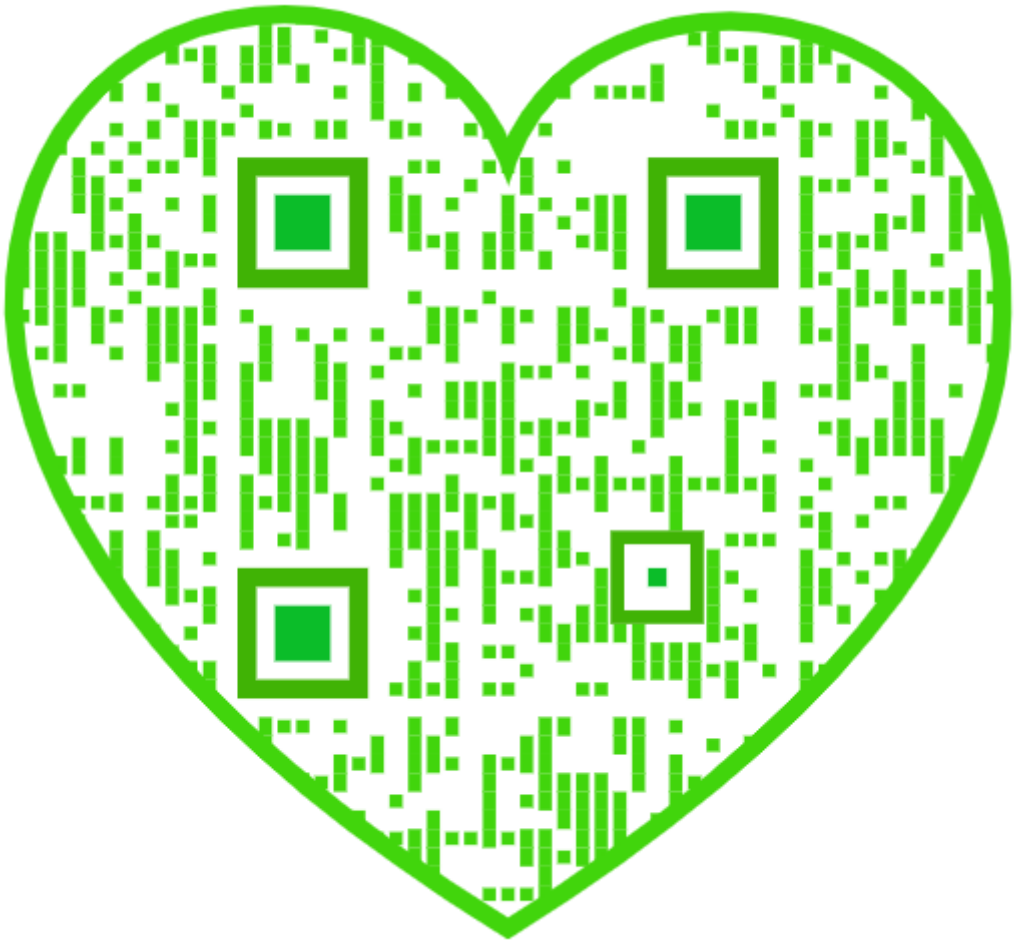

	Cubic feet Timber.	Pounds Iron.	Cubic yards Stone.	Cost.
Temporary Dam....	134,500	92,000	11,400	$79,000
Permanent Dam....	265,000	438.600	24,000	151.000
Slides, Booms, Piers.	296.400	156,400	32,800	102,000
	695.900	687,000	68,200	$332,000

DOES GOOD WORK PAY?

Properly considered, this question admits of but one answer, and yet there are advocates of "cheap" work and excusers of slighted jobs among our manufacturers; men who claim that close competition and close bargaining are circumstances which permit, if they do not exact, passable rather than excellent work. A business run among the shops and factories in the same line of production, in the same or adjacent localities, where each shop has equal or similar facilities, shows that no two of them will furnish the same estimates of the same job. Indeed, in some instances, the difference in the terms is quite surprising when it is considered that the materials and the methods and facilities of working them are the same. Under these circumstances the only possible means of lowering price is by slighting work, sure to be detected sooner or later, to the injury of the maker's reputation and the ultimate loss of the cream of his business. This is particularly true of the manufacture of tools and machinery; in either case poor workmanship is certain to reveal itself. And when a tool gives out in the using, or a machine breaks down, the user and owner does not console himself with the consideration that he "got it cheap," but he execrates the maker as heartily as though he had paid the highest market price; and he goes no more to the low-priced manufacturer, neither does he recommend his productions.

The manufacturer who "puts the work" into his tools and machinery is building up for himself a cumulative extending reputation for excellence of product that is far more valuable than a reputation for low prices only. In fact, the price of a piece of work is not absolutely high nor low; it bears a relation to its cost of production. A high priced article may be cheaper than a low priced one, and should be if the proper relation between price and value is preserved. In fact, high prices do not repel so many would-be customers as first-class workmanship attracts.

The truth of this could be attested by the success of a firm whose productions have a reputation extending far beyond the limits of this country. Their specialty is the manufacture of machine tools, and within less than twenty-five years has grown from a shop of four employes to an establishment of more than seven hundred hands. At the beginning the tools made by this company bore a high price, and as compared with most others in the same line of manufacture the prices have always been high. Yet the fact of the building up of a large business from insignificant beginnings proves that the high prices have not offset the benefits arising from good work. And that has been the main object for which this company have striven from the first. No job ever went out from this establishment "scrimped" in workmanship because of an error in contracting too low. "Better lose dollars than reputation," has been the principle of the company. They have always used the best materials, employed the best skill, exacted the finest work, and aimed at producing superior tools. For years their name has been synonymous with the highest possible excellence in their line, and their tools are regarded as standards of comparison. Substantial prosperity has kept pace with constant improvements, and it is much more the result of producing first-class work than of shrewd business management or fortunate contracts.

This single case, taken as an example for illustration, is not an isolated and peculiar one. There are producers by manufacture in this country and others whose name is a guarantee of excellence, a protection to purchasers and users, and an evidence of the prosperity almost certain to follow earnest, honest endeavor to do good work.

Arizona Coal.

The Deer Creek coal fields, near the San Carlos Reservation, Arizona, promise great results. They were discovered in 1881, and active developments began last March. The coal is found in fifty veins of greater or less size, which have been open, and extends for a full mile in width. Seven shafts have been sunk in different places on the property, the deepest being some 200 feet. In this deepest shaft, as in all the others, the coal has been followed all the way down, and at the depth of 150 feet a cross cut has been made through 30 feet of sandstone, striking another vein of coal 15 feet wide. Above this shaft, on the next vein, a 100 foot tunnel has been run, showing a face of 8 feet of coal about 45 feet from the surface. A cross cut from this tunnel shows a vein of 7 feet of coal at the same depth. West of this tunnel, and about 100 yards distant, there is a shaft of 40 feet down on an incline, so that any one can walk in at any time and see one of the finest bodies of coal on the property. In addition to these developments there are several other shafts where the veins have been cut, showing coal from 6 to 25 feet in width.—*Arizona Star.*

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NEW YORK, SATURDAY, APRIL 28, 1883.

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THE GREAT BRIDGE ALMOST COMPLETED.

The trustees of the great suspension bridge over the East River, between New York and Brooklyn, have announced that the structure will be thrown open to the public on the 24th day of May, 1883. This will be a notable day in the history of these two large cities. The event will be celebrated by festivities appropriate to the occasion. Probably half a million of people will join in the procession across the bridge, forming a rare and wonderful sight. The question of fares and tolls is yet to be settled. In addition to ample space for foot passengers and ordinary vehicles, there will be a double track railway, with commodious passenger cars, constantly moving back and forth, like shuttles over the bridge.

RELATIVE COSTS OF STREET LIGHTING BY ELECTRICITY AND GAS IN NEW YORK.

New contracts for lighting the streets of the great city of New York have just been awarded, to begin May 1. The price to be paid for gas lighting for the closely inhabited part of the city, in which by far the larger portion of the lamps are located, is $17.50 per year per light. In the outskirts and sparsely inhabited regions, from $19.50 to $32 per gas light is to be paid.

The use of electric lights will be continued in portions of Broadway, Fifth Ave., including certain parks and squares, in all a length of about six miles, at 70 cents per night per light. Arc lights are used of the Brush Company, also of the United States Company's styles. Each electric light displaces six gas lights. The contract price for each electric light amounts to $225 per year per light, which is rather more than double the cost of gas in the chief parts of the city. It is conceded, however, that the quantity of light furnished by an electric lamp is much greater and better than that yielded by the six displaced and dingy gas lamps. The streets that are illuminated by the electric light present an attractive and brilliant appearance. Reckoned by quantity of light supplied, the arc lamps are far cheaper than gas. Not so, however, with the incandescent system—the Edison system, for example, which is not at present used for street lighting in New York. Each small Edison light, not quite equal in force to an ordinary gas light, costs rather more than gas.

MAKING A DRILL CHUCK.

In these days, when almost every appliance used in the machine shop may be obtained ready-made, at any mechanics' supply store, it may seem unnecessary to suggest methods of fitting ordinary lathe appliances. But there still are many shops unprovided with attachments of a handy character except these which are home-made, and even when the ready-made articles are obtainable there may be occasions when the workman finds it preferable to get up his own attachment.

There are plenty of handy drill chucks to be found in the market suited to almost all the exigencies of work, but if the contingency just referred to should arise, it is well to know how to produce a good drill chuck from shop materials and appliances.

The preferable method of making a drill chuck to be used in the lathe is to drill, bore, and thread a suitable block to screw on the live arbor of the lathe, in place of the face plate. A cylindrical casting, or a piece cut off the end of a bar of round iron, will furnish the stock for the chuck. Drill a hole in one end of this of sufficient length to comprehend the threaded portion of the lathe arbor and the lathe center, the hole being of sufficient diameter to receive the center. Then enlarge this hole by boring to a depth sufficient to receive the threaded portion of the lathe arbor, and chase the thread in the hole to fit the arbor.

The first stage is now completed. Screw the block on the lathe spindle, and drill, from the other end, the hole for the reception of the drill shank. Turn and finish the outside of the chuck to taste. With a chuck of this sort there is no necessity of removing the lathe center when the chuck is to be used.

Sometimes the workman wants a drill chuck that shall take the place of the center in the lathe arbor. In this case the drill chuck must have a tapering shank corresponding with that of the lathe spindle center. The turning of this shank on the proposed chuck is frequently the first part of the work attempted. This is an entire reversal of the proper method; it is impossible to get the true center of the piece proposed for the chuck by this wrong method.

To produce a chuck of this style, cut a piece off a bar of round iron of the proper diameter for the boss of the chuck, and long enough to receive the shank of the drill and to form the shank of the chuck that takes the place of the shank of the lathe center. Chuck the piece and drill the hole for the reception of the drill shank. Then lay the unfinished chuck aside, and cut another piece long enough to form a shank to fill the receptacle of the center shank in the lathe arbor, and the hole just drilled in the proposed drill chuck.

Turn this piece to fit the center hole in the lathe arbor accurately, put it in place, and then turn the projecting portion to fit the hole in the proposed chuck. Drive the chuck on, and by rotating it the true center will be found. From this center turn the shank for the hole in the lathe arbor, and perfect truth will be assured.

A CUBIC foot of water weighs 62½ pounds, and contains 1,728 cubic inches, or 7½ gallons.

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ASPECTS OF THE PLANETS FOR MAY.

NEPTUNE

is evening star until the 9th, and morning star for the rest of the month. He wins the first mention on the May roll, for he is the first of the four great planets, now playing the part of evening stars, to reach conjunction with the sun. He arrives at this important point of his course on the 9th, at 8 o clock in the morning. He is then in a straight line with the sun and the earth, the sun being in the center, the farthest from the earth possible, and farther off than any other known planet can be, his distance being 2,863 million miles. He is in conjunction or "joined to" the sun, rising and setting with the sun, and completely hidden behind the great luminary. After conjunction, he passes to the sun's western side, becomes morning star, and continues to play the role till the 12th of November, when he has swung round to the opposite quarter of the heavens, and is in opposition, his most interesting phase to observers.

If we could, at the time of Neptune's conjunction, take a bird's eye view of the solar system from a point above the earth, and were gifted with a power of vision to behold the family of worlds that circulate about the sun, we should see a wonderful picture. The central point of view is the huge globe of fire we call the sun. Our insignificant planet is brightly shining beneath our point of view on one side of the sun, and directly opposite, on the other side, Neptune's great orb lies on the system's remotest limits. A little to the east, Saturn with his rings and moons is swinging on toward conjunction. The giant Jupiter still farther east is making rapid strides toward the same goal. Uranus is plodding in the same direction, not having accomplished half his course. Mercury, small in size and nearest the sun, moves eastward with flying feet, between Saturn and Jupiter, in his swift course toward elongation, and completes the list of the five planets that are on the sun's eastern side. On his western side, Venus and Mars are seen, the one approaching and the other receding from the sun, within a day of passing each other. A diagram of eight concentric circles would form a simple means of recording from month to month the relative position of the planets in regard to the earth and the sun.

The right ascension of Neptune is 3 h. 5 m., his declination is 15° 37′ north, and his diameter is 2·5″.

Neptune sets on the 1st at twenty-four minutes after seven o'clock in the evening; on the 31st he rises about half-past three o'clock in the morning.

SATURN

is evening star until the 20th, and morning star for the rest of the month. On the 20th, at six o'clock in the evening, he takes his turn and comes into conjunction with the sun, ten days after Neptune. He carries out the same conditions described for Neptune, excepting that he is not so far off, his distance at conjunction being 1,014 million miles. Like his more remote brother planet, he passes to the sun's western side and becomes morning star.

On the 1st, at eleven o'clock in the evening, Saturn is in conjunction with Mercury, being about four degrees south of him. The planets set at that time about a quarter after eight o'clock, more than an hour after sunset, Saturn being south of the Pleiades, and Mercury about half way between them. Planets and Pleiades are low down in the west, but a good opera glass, a clear atmosphere, and a cloudless sky will bring them to view.

The right ascension of Saturn is 3 h. 40 m., his declination is 17° 44′ north, and his diameter is 15·4″.

Saturn sets on the 1st about a quarter after eight o'clock in the evening; on the 31st he rises about a quarter after four o'clock in the morning.

JUPITER

is evening star during the month, following in the wake of Neptune and Saturn toward the same goal, but far behind them in the race. On the 23d, at three o'clock in the morning, he is in conjunction with Mu Geminorum, a star of the third magnitude in the constellation Gemini. Planet and star approach nearest to each other at three o'clock on the morning of the 23d, being then fifty minutes apart. But they will be worth looking for on the evening of the 22d. Mu Geminorum is very near the ecliptic, and two degrees east of Eta or Tejat, a star near the position of the sun at the summer solstice, the dividing line between the tropic and the north temperate zones.

The right ascension of Jupiter is 5 h. 57 m., his declination is 23° 25′ north, and his diameter is 31″.

Jupiter sets on the 1st, about a quarter before eleven o'clock in the evening; on the 31st he sets a quarter after nine o'clock.

URANUS

is evening star. He has not completed half his course on the way to conjunction, though he is approaching quadrature.

The right ascension of Uranus is 11 h. 22 m., his declination is 4° 53′ north, and his diameter is 3·8″.

Uranus sets on the 1st at three o'clock in the morning; on the 31st he sets at a few minutes after one o'clock.

MERCURY

is evening star during the month. On the 14th, at five o'clock in the morning, he reaches his greatest eastern elongation, and is 21° 55′ east of the sun. This beaming planet may be easily found at elongation and for ten or twelve days before and after. His high northern declination makes the conditions for observation more favorable than will occur again for a long time, and he will be easily picked up during nearly the whole month. On the 14th he sets at nine o'clock, nearly two hours after the sun, a very rare occurrence. He may be found at that time about fifteen degrees west of Jupiter and a little farther north; about twenty degrees south of Capella; and six degrees north of the sunset point. An idea of Mercury's rapid motion may be inferred from the fact that on the 1st, when in conjunction with Saturn, he was between that planet and the Pleiades. On the 14th he has traveled far away over the sky-depths. He is then twenty degrees east of the cluster, while Saturn has scarcely changed his pose.

The right ascension of Mercury is 3 h. 38 m., his declination is 21° 26′ north, and his diameter is 6″.

Mercury sets on the 1st, about a quarter after eight o'clock in the evening; on the 31st he sets at six minutes after eight o'clock.

VENUS

is morning star and has so nearly approached the sun that she rises only an hour and a quarter before him. On the 10th she is in conjunction with Mars. The planets make their nearest approach at one o'clock, but they will form a pleasing picture on the morning sky when the earth has rolled far enough on her axis to bring them above the horizon. The planets rise about half past three o'clock on the 10th, an hour and a quarter before the sun. Venus will be easily found, and about forty-eight minutes south a small red star will be seen, which is the planet Mars. An opera glass or a very bright eye will bring him into the field.

The right ascension of Venus is 0 h. 18 m., her declination is 0° 12′ north, and her diameter is 14″.

Venus rises on the 1st at thirty-nine minutes after three o'clock in the morning; on the 31st she rises at ten minutes after three o'clock.

MARS

is morning star. We have described the only incident in his course.

The right ascension of Mars is 0 h. 32 m., his declination is 2° 16′ north, and his diameter is 4·8″.

Mars rises on the 1st about a quarter before four o'clock in the morning; on the 31st he rises a quarter before three o'clock.

THE MOON.

The May moon fulls on the 21st, at twenty-seven minutes past ten o'clock in the evening. The waning moon is in conjunction with Venus on the 4th, and on the same morning, four hours later, with Mars, showing how near the planets are to each other. On the 6th the four-hours-old moon is in conjunction with Neptune. On the 7th the one day-old crescent is in conjunction with Saturn, being eighteen minutes north. The moon sets on that evening more than an hour after the sun, and it is barely possible that, under the best conditions of atmosphere and sky, the near approach of crescent and planet may be seen. On the 8th the moon pays her respects to Mercury, on the 9th to Jupiter, and on the 16th to Uranus. Those who watch the conjunctions of the moon with the planets will find this an easy way of impressing upon the memory the relative position of the planets in regard to the sun.

THE OCCULTATION OF BETA SCORPII.

On the evening of the 21st the moon occults Beta Scorpii, a star of the second magnitude in the constellation Scorpio, ranking next in brightness to its leading brilliant, Antares. It is also a fine double star. The larger component is of the second magnitude, pale or yellowish white in color; the second component is of the fifth and a half magnitude and of a lilac color. The stars are thirteen seconds apart. The moon is half an hour past the full at the time of the occultation, so that nearly her whole disk will be illumined. An observer with a telescope large enough to separate the star will behold a beautiful spectacle. About eleven o'clock (the Washington time is thirty-two minutes after ten o'clock) the larger star will disappear behind the moon's bright edge, and in less than a minute the tiny companion will follow. This is the immersion of the star. The occultation will continue for an hour and a half. About half past twelve o'clock the companion stars will reappear at the opposite edge of the moon. This is the emersion of the star. The occultation may also be observed with a good opera glass, which, however, will not separate the star into its component parts. The bright moonlight will obscure the view to the unaided eye. The moon is constantly occulting the small stars lying in her path, but she does not often encounter a star of the size of Beta Scorpii.

The moon contributes the largest portion to the incidents of the month. For besides the close conjunction with Saturn, and the occultation of Beta Scorpii, she gets up for a favored few in the South Pacific Ocean the grandest and most sublime exhibition ever witnessed on this planet, when for six minutes she hides from mortal view the glorious orb of day.

State Geologist's Report of New Jersey.

The State of New Jersey's geological report for 1882 has just been published, and as usual with Prof. Cook's reports, the present one contains a great deal of information, not only useful to the citizens of New Jersey but to scientific men and students everywhere. The report contains maps and illustrations of some of the most interesting geological formations in the State.

AN ARTIFICIAL AURORA BOREALIS.

Laboratory experiments have frequently been resorted to to produce the aurora in miniature, and the resemblance to the original has been extremely close, but an artificial aurora on a large scale and with no electrical machinery has lately been effected by Prof. Lemstroem. He selected a station just within the Arctic circle, in North Finland, where there were two mountains close together and having altitudes of 2,600 and 3,600 feet. In accordance with the well known fact that electricity gathers upon points, two hills having clearly defined conical summits were selected.

He believed that aurora was the result of an endeavor on the part of certain forces to establish an equilibrium, and assumed that electricity was passing from one hill top to the other. Reasoning that if by any means this interchange could be hastened the effect would become visible, the summits were connected with their bases by a network of copper to serve as a conductor. Immediately an arch of the aurora appeared, estimated to be at least 360 feet above the top. An examination of the currents produced in the wires showed them to be positive. The spectroscope clearly revealed the well known lines of the aurora. Although the display was only of short duration, there could be no doubt of its genuineness or of the success of the experiment.

SEALS IN LONG ISLAND SOUND.

BY H. C. HOVEY.

The seal delights in cold water. To resist its chilling influence, nature has clothed it with thick fur, and wrapped the body in a layer of elastic fat. There are several varieties of this curious amphibian, and the pursuit of seals for their oil and skins and fur is an important source of national wealth. Steamers are constructed especially for this purpose, capable of resisting the pressure of the ice-fields where the most successful hunting is to be found. Not mentioning the seal-fur trade of Alaska, the annual production of seal oil from the fisheries of Newfoundland and Labrador amounts to 1,500,000 gallons, and that of Greenland is valued at about $300,000 more. In the height of the season it is said to be no uncommon sight to see 15,000 dead seals on the battle-field of a single night's contest with the hunters.

When I first published the statement that seals were formerly common in the waters of Long Island Sound, it was doubted by many if a creature so plainly Arctic in its preferences had ever frequented these more southern waters. According to colonial legends, their favorite basking place was the famous Red Rock in the estuary of the Quinnipiac River. The sailors of that time called them "sea-dragons," and for that reason this locality was, for more than a century, known as Dragon Bank. The name extended to the settlement since called Fair Haven, now included in the limits of New Haven. And the bridge by which it is joined to the rest of the city still bears the name of the Dragon Bridge.

My interest in these local legends has led me to ask the fishermen to report any instances occurring of the capture of seals in Long Island Sound. The result is that, especially since the introduction of the large nets now in use, I hear of a few seals as seen or caught every year. The number is insignificant from a commercial point of view, but enough to warrant the stories of their being plentiful here in colonial times, before the Sound was disturbed by steamboats, fog-horns, and other things that must seem alarming to such a timid animal. About four years ago a solitary seal was observed near the old place of resort at Red Rock; and about the same time another was captured at the Tomlinson Bridge, both these places being within the limits of New Haven! The latter specimen was stuffed and properly labeled as *Phoca vitulina*, and assigned a conspicuous place amid the myriad curiosities of the Peabody Museum. It was a comparatively small individual, not weighing more than forty pounds. Its color is now a yellowish white, which may be due to the action of the oil on the fur since it was dressed.

The long, severe winter just over seems to have led the seals southward, and numbers have been recently seen in the Sound. Two fine specimens were caught, April 11, near Guilford, Conn., by Messrs. Crittenden and Rackett, who found them smothered in their shad net. One of the pair was a male, weighing 86 pounds, dark haired, and spotted like a leopard. The other, a female, weighed 75 pounds, and was clothed with soft, silvery wool. They were brought to New Haven, and exhibited by Mr. H. R. Shepperd at the City Market. They will probably be secured for the Peabody Museum, where so many objects have already been placed illustrating the natural history of New England and its adjacent waters.

Microscopic Animals in Bricks.

The weathering of brick walls into a friable state is usually attributed to the action of heat, wet, and frost; but from recent observations of M. Parize, the real destroyer is a microscopic creature, and the action played by the weather is only secondary. He has examined the red dust of crumbling bricks under the microscope, and found it to consist largely of minute living organisms. A sample of brick dust taken from the heart of a solid brick also showed the same animalcule, but in smaller numbers. The magnifying power of the instrument was 300 diameters. Every decaying brick showed the same kind of population, but the harder the brick the fewer were noticed.

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BULKHEADS FOR STEAMSHIPS.

One of the most important papers read at the recent meeting of the Institution of Naval Architects, London, was that by Mr. James Dunn, on the above subject. Our engravings are from the *Engineer*.

The author dealt with vessels of the mercantile marine, and submitted three propositions for consideration: (1) Is the subdivision of a merchant ship by watertight bulkheads practicable, and consistent with commercial requirements? (2) Can these bulkheads be made sufficiently strong to withstand the pressure of water under all circumstances? (3) Are bulkheads of any value in securing floating powers for the ship in the event of damage from collision or other causes? He began by sketching the history of bulkheads, and went on to consider the forces acting on bulkheads. He assumed one compartment laid open to the sea by the tearing of the side plating, and we shall have—(1) The statical pressure due to the given depth of water in the hold when the ship is at rest and no cargo on board. (2) That due to the pressure when the holds are wholly or partially filled with cargo, and the ship still at rest. (3) That due to the extra pressure when the ship is under way, or alternately rising on the crest or falling to the hollow of a wave. (4) That due to the rolling, pitching, and 'scending of the ship herself.

He then considered the effect of these strains, and said that in constructing bulkheads the very general practice is to adopt the rules laid down by Lloyd's Registry, which provide for plating $\frac{4}{16}$ in. in thickness for a 1,000 ton ship to $\frac{7}{16}$ in. in thickness for the largest class. In the smaller ship the plating is stiffened with vertical angle bars, with flanges of 3 in. and 2½ in. in width, and $\frac{5}{16}$ in. in thickness, placed 30 in. apart; and for the largest type of ship, with the thicker plating, these vertical stiffening bars are still placed 30 in. apart, but the flanges are each 4½ in. wide, and their thickness is increased to $\frac{7}{16}$ in.

Where a deck exists, it of course acts as a longitudinal stiffener or prop; and where the internal arrangements dispense with a deck, but where the distance between the horizontal angle bar at the head of the bulkhead and the floor exceeds 8 ft., an angle bar equal to the main frame of the ship is riveted to the bulkhead on the opposite side to that on which the vertical stiffeners are placed and arranged horizontally; and where this distance exceeds 12 ft., two such stiffeners are provided, and so on, the number of them being added to as the depth increases.

These arrangements, he submitted, if efficiently carried out, should be sufficient to enable the bulkheads to hold their own in ships of the narrower type; and, as a fact, we know they have actually withstood the test under severe trials. Three years ago 50 ft. was a great beam, but we have now an Atlantic liner with a beam of 57 ft.; and the time had come for us to consider what additional means must be adopted to secure the safety of bulkheads. He urged now for ships of great breadth, and for bulkheads of great area, that a vertical web-plate should be fitted at the middle line, say from 12 in. to 24 in. in depth, with angle bar flanges, and secured to the bulkhead and to the several decks and the floors; and some of the angle-bars between it and the sides of the ship replaced by good stiff bars of a Z section. He next contended that bulkheads are useless if not wisely placed, nor carried high enough, nor efficiently cared for; they are useless when found, as he had found them, with stiffeners cut, with rivets omitted, with calking neglected, with plates removed, with large holes cut for small pipes to pass through, with sluice holes and no covers, with doors and worthless securities, or with open doors rusted and unmanageable, or with doors in the holes fastened open in such a way that they cannot be closed without "handling," and are out of reach at the moment of danger.

He would go further, and say that they are not only useless, but that under some circumstances they are positively dangerous. This might, perhaps, be thought a serious and startling assertion; but he would take the case of a ship illustrated by Fig. 1—and there are many such ships now afloat—in which a good number, a really large number, of bulkheads are provided and distributed as shown, but three of which, it will be seen, are stopped at the deck, which is awash. The bottom gets damaged and springs a leak, say in No. 1 hold, or in No. 2 hold, or in both; and how many such cases had they known where the water enters and gains on the pumps, and slowly, but surely, rises to the top of the dwarf bulkhead, causing the ship to trim as indicated in Fig. 2. The water is then free to flow over the top of the bulkhead and pour into the next hold, the effect of which is inevitably to send her head first to the bottom.

The author held that such a ship would keep afloat with the water in No. 1 hold and in No. 2 hold, provided it is confined by the bounding bulkheads being carried a few feet higher than the natural level. What this natural level is, and to what height the bulkhead should be carried, are points readily determined by the navel architect. But if they are not carried up, but are left as shown—and in too many cases they are so left—then the author held they had better not be in the ship at all, as they would contribute to her loss by keeping the water at one end of the ship and carrying her bows under; whereas, if they are not fitted, the same volume of water entering as is indicated in the preceding diagram, and not being confined to one end, will distribute itself through the ship all fore and aft, in which case the trim is preserved, and she will still float in the position indicated in Fig. 3. Here, although the freeboard is reduced, she will still be seaworthy; the fires may be kept burning and the machinery going sufficiently long to bridge over the space dividing life from untimely death.

Taking two other cases, in one of which the bulkheads were well placed and cared for, and proved that under such conditions they may be of the greatest value; the other case is in all respects a contrast. In the first case they were placed in the positions and carried to the height indicated in Fig. 4. A steamer of nearly 5,000 tons ran into this ship in a fog, struck her abreast No. 3 bulkhead, opening up two compartments to the sea; but, fortunately, the bulkheads had been carried to a reasonable height, and the water could not get beyond them; they stood the test, she did not sink, but she kept afloat at the trim shown in Fig. 5, and in this condition steamed 300 miles safely into port.

Happily, they are now getting a number of such ships, and many similar facts giving actual beneficial results might be placed before them if time would permit, so he would consider the next case, where we have the same number and a similar disposition of bulkheads as in the previous case; but, unfortunately, some of them are rendered valueless by being stopped at or about the water line, as indicated in Fig. 6. This sketch represents a large number of first class steamers now afloat, and should such an accident happen to any of them as has just been described, they would certainly not have the good fortune to complete their journey, as in the last case; but the water, not being confined to the two holds numbered two and three, as it was in the previous case—which is an actual one—will pour over the top of the dwarf bulkhead into the foremost hold, and the ship will soon get into the position indicated in Fig. 7. Water will then be reported to be making in the engine room, if, indeed, she should not disappear before then.

The author then referred to models exhibited at Spring Gardens. The models are loaded with weighted wood blocks, the blocks being of a bulk to represent the cargo in a passenger ship floating at an ordinary load draught with each compartment below the upper 'tween decks appropriated to cargo, having one-half its space occupied—a condition ordinarily assumed at the Admiralty when determining whether a ship is qualified for the Admiralty list—and they fairly represent such a ship as regards their measure of stability. A hole is made through the bottom plating, to represent an actual hole about one square foot in area, and eight feet below the water surface in each compartment, and a plug is placed in it, so that by removing a plug any part of the model may be laid open to the water. The first, which we will call B, or the badly bulkheaded model, very soon disappears after the withdrawal of any one of the plugs, because the water rushing in soon rises to the level of the water outside, and is then, or before then, free to flow over the top bulkhead into the adjoining hold.

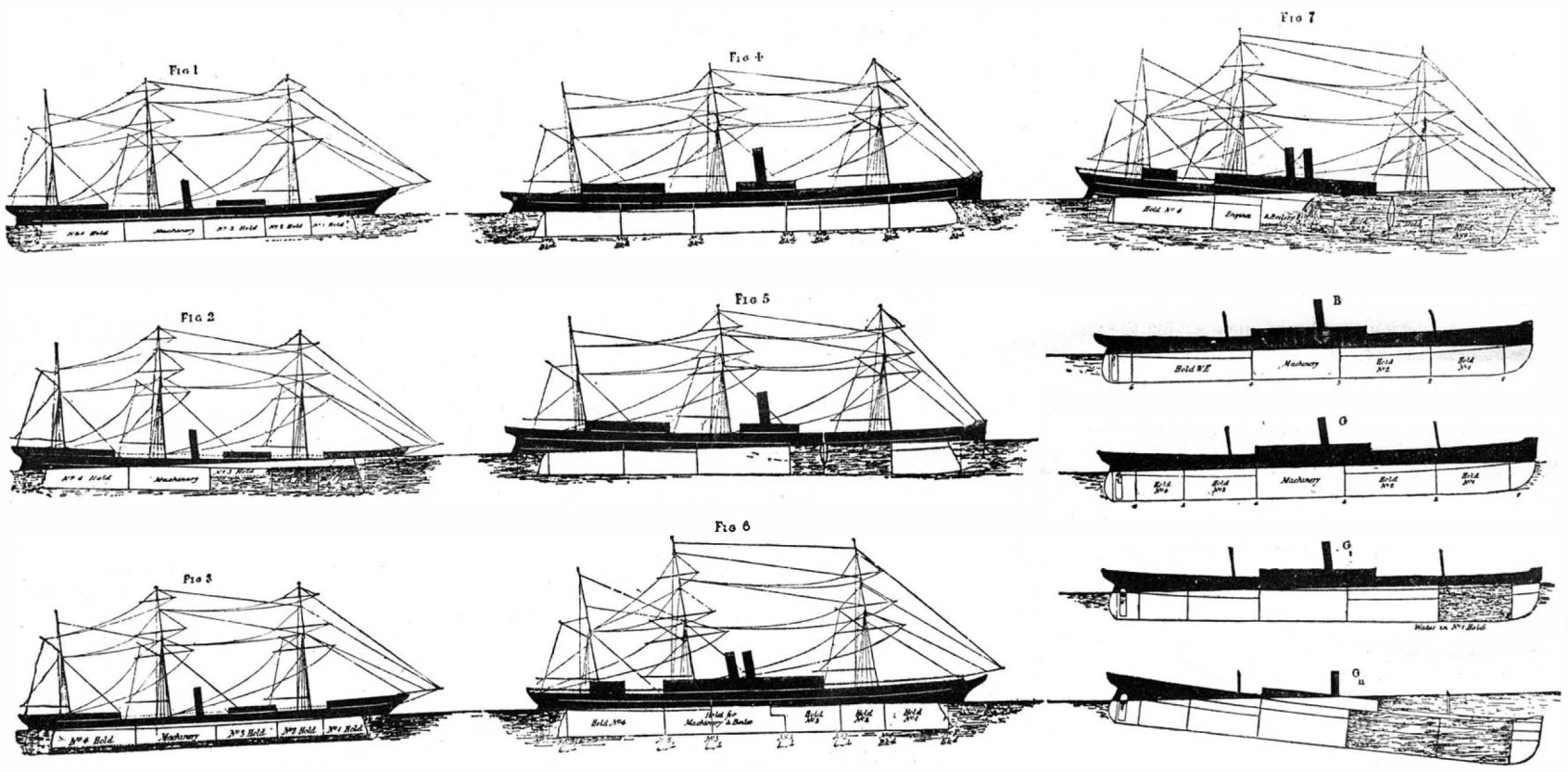
Take, for example, the plug out of the bottom in way of No. 1 hold. But if the corresponding hole in the good, or G, model is opened up, the water soon gets in and find its level, but it is then confined between the bulkheads, and the model remains afloat in the position indicated in G_1. Whatever experiment is made in this direction with the B model, the result is the same, viz., she goes down; so we will dismiss her from further consideration, and go back to the G model. Her position with the forward compartment filled is shown in sketch G_1, and that sketch also represents the trim she would take if the damage were to occur in the second hold from forward instead of the first, because although this No. 2 hold may be and often is the larger, it is nearer the center of gravity of the water plane, the leverage is less, and the effect on the trim is modified. Take another case, and open up both the forward holds Nos. 1 and 2. Of course, we expect that the ship will then go down, because the alteration of trim will be so great that the top of the boiler room bulkhead, although carried to the upper deck, is dragged below water, and the engine room becomes filled; and thus we have the forward three compartments full, which would undoubtedly sink her.

But suppose we keep the water out of the engine room, which we can do by making water tight the casing round the funnel and engine room hatch to, say, 8 feet above the deck. In smooth water the ship would have buoyancy and stability, even when in this damaged state, and would float, as indicated in sketch G_{11}. As an illustration of the great general importance of the subject of bulkheads in merchant steamers, the following statistical details and deductions should be of interest. The advantages of good subdivision are broadly indicated in the annexed table, showing the number of vessels and the losses for six years ending December, 1882:

	Number.	*Losses.*	*Average loss per annum.*
Ships qualified for the Admiralty list.....	157	1⅝	1 in 86
Ships not qualified for the Admiralty list,	3,483	136	1 in 25

These figures are very significant. It appears from them that the chances of loss from any cause are nearly four times as great for a ship not constructed to qualify for the Admiralty list as for a ship entered on that list. This proportion is greatly due to the almost absolute immunity from loss by collision of ships on the list, for during the first four and a half years of its existence not one ship was lost from it by collision, although a considerable number of the qualified ships had been in collision, and escaped foundering on account of the safety afforded by their bulkheads.

Within the last year, however, they had had six casualties to ships on the list, and among them was our only loss by collision. In that case the whole of the ship—a small one—



DIAGRAMS OF BULKHEADS FOR OCEAN STEAMSHIPS.

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was flooded abaft the engine room, the two after holes being opened to the sea. This was a case such as they have no merchant steamers afloat capable of surviving. During this time the whole of the losses from the Admiralty list—eleven in number—have been from drifting on rocks, or otherwise drifting on shore, with the solitary exception above quoted. In the same period seventy-six ships have been lost which had been offered for admission to the Admiralty list, but had not been found qualified; of these, seventeen, or 22½ per cent, were lost by collision, and ten, or 13¼ per cent, were lost by foundering; most of the rest stranded or broke up on rocks. That the general superior character of the ships on the list is of no value in reducing the risk of collision is shown by the following comparison.

It can be proved that of the entire British mercantile fleet of steamers about 1 per cent, without distinction, receive damage of a fatal character by collision during the year. Of the number thus damaged, those on the list remain afloat, while those not on the list are lost. This is deduced from the following figures: Referring to the table given above, he would take only those cases of collision to ships on the list which would have proved fatal but for their compliance with Admiralty requirements. These are 9, or an average of 1½ per year, giving 1½ in 157, or 1 per cent of prevented fatal cases. Again, the average number of ships sunk by collision per year from the unqualified part of the fleet is 35, and the average annual record of the fleet for the six years is about 3,500, also giving 1 per cent of—in this case—fatal cases. Thus the risk of fatal collision is about 1 to 100, irrespective of the class of ship, and thus ships on the Admiralty list enjoy almost absolute immunity from loss by this cause. It is therefore proper to consider that the vessels on the list have no natural advantages with regard to their safety beyond that due to their bulkheads.

Two New Gelatine Emulsions.

F. Knebel offers the following formula: 20 parts of hard gelatine (Winterthur) are soaked in 200 parts of distilled water (1 in 10 by weight) and afterward dissolved by heating. He then adds 24 parts of potassium bromide and ¼ part of potassium iodide in solution, and 3 or 4 drops of acetic acid or 0·1 part of citric acid. Secondly, he dissolves 30 parts of crystallized silver nitrate in 100 of water. Thirdly, a gelatine solution for subsequent use is made of 14 parts of hard gelatine and 6 parts of soft gelatine, for summer use; but if it is to be used in winter, 10 parts of each are taken. They are softened first, and then dissolved in 250 parts of water. The silver nitrate solution is *gradually* poured into the first gelatine solution and the vessel rinsed with half as much water (50 parts), which is also added. The emulsion is now digested for two hours on a water bath at 65° or 70° C. (150° or 160° Fahr.). It is quickly cooled to 30° C. (86° Fahr.) by placing it in cold water. Next, 6 or 7 parts of ammonia (specific gravity, 0·920) are added to No. 3, which must be nearly cold and not very fluid. It is well stirred and then poured into the emulsion, which is at 30° C., shaken thoroughly, and filtered through flannel and afterward in Braun's apparatus, after having first been pressed through canvas and well washed. It is now ready to be poured upon the plates to dry. Another method, by Pizzighelli and Hubl, is called the cold method.

No. 1. One part of gelatine, 50 parts of water, 2 parts of ammonium carbonate, 15 parts of ammonium bromide, 2 parts of potassium iodide solution (1 to 10), 140 parts (by volume) of 92 per cent alcohol, from 1 to 5 of ammonia water.

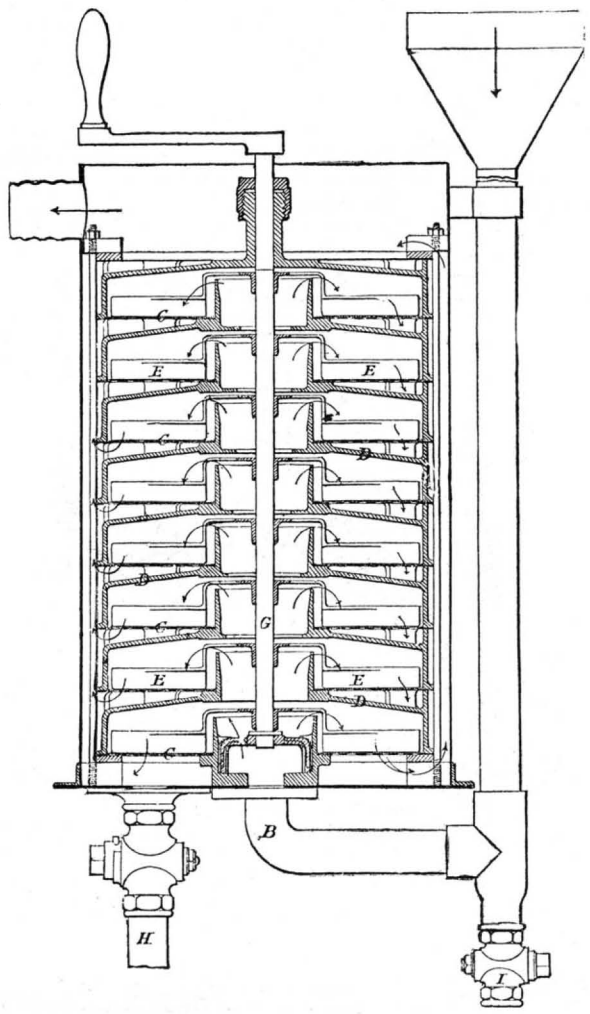
No. 2. Silver nitrate, 20 parts in 100 parts of water.

No. 3. Hard gelatine, 24 to 30.

The constituents of No. 1 are mixed in the order there given, except the gelatine, which is softened and dissolved, then added. The more ammonia the softer and more sensitive the photographic film. The emulsion is formed as usual by adding No. 2 to No. 1, under the well known precautions. They are digested as usual about five hours, then the emulsion is poured into a beaker glass and No. 3 stirred in, allowed half an hour to soften, and completely dissolved on a water bath. It is now rapidly stirred and 500 parts (by volume) of strong alcohol added, which precipitates the emulsion. The lumps that form are melted in small portions and poured into cold alcohol, where it is stirred with a glass tube, two inches in diameter, closed at the lower end. The emulsion attaches itself to the tube, and is then washed half an hour in flowing water.

PIEFKE'S FILTER.

The filtration of water is, from both a sanitary and manufacturing point of view, one of daily increasing importance; our rivers are becoming more and more polluted, and the value of space is increasing too rapidly to admit of large sand filtering beds and settling tanks being adopted for the purification of water for domestic and manufacturing purposes. The filter which we illustrate from *Engineering* is designed to combine in the smallest possible space the largest and most effective filtering surface, and differs not only in construction but also in the material used from any previously employed. It is the invention of Mr. Carl Piefke,

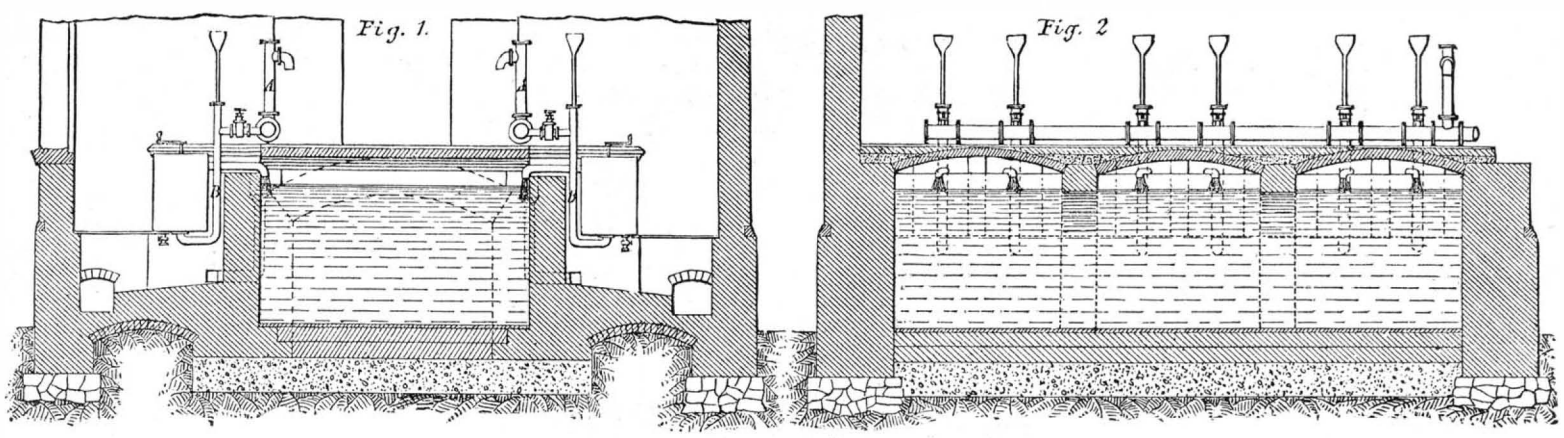


PIEFKE'S IMPROVED RAPID FILTER.

chief engineer of the Berlin Water Works, and is manufactured by Messrs. G. Arnold & Schirmer, engineers in Berlin; it has been adopted in several large industrial establishments on the Continent on an extensive scale.

Our illustrations, Figs. 1 and 2, show a general arrangement of a filtering plant, consisting of twelve of these filters, each capable of purifying 1,100 gallons per hour. A large reservoir in the center of the building collects the clean water; the filters are grouped two and two, in two rows of six each side, and are supplied with water through the mains, A, A, while the funnels serve to charge the filters with the filtering material. Three tanks, together with thirty-six filters, have been recently fitted up by Messrs. Arnold & Schirmer at a large bleaching establishment near Warsaw, where about 800,000 gallons of filtered water are used daily.

The filter itself, shown in section in Fig. 3, consists of a wrought-iron casing containing a number, here twelve, of perforated brags, C, which form the bottom of flat bell-shaped cast-iron vessels, D, the whole grouped one above the other inside the casing. The water to be filtered enters by the funnel, A, and through pipe, B, runs into the vessel, overflowing in the direction of the arrows, and after passing through the filtering material spread upon the perforated brags, C, rises till it overflows at the outlet. The filtering medium is chemically prepared cellulose or vegetable fiber, and is variously treated according to the purpose for which the filtered water is to be used, or, in other words, according to the degree of purity required in the filtered water. Its price varies accordingly; the best quality is charged at 75s. per cwt., and a filter capable of purifying 1,000 gallons of water per hour requires, for its first charge, about 3 lb. of filtering material. To charge the apparatus, the fiber is mixed with water to a thin paste and admitted through the funnel, when it deposits in an even layer over the perforated surfaces, C, and the filter is then quite ready for action. After about 1,200 gallons of water have been purified per square foot of filtering area, the latter requires cleaning or washing out; this is performed in a very simple manner by charging the filter with water in the usual manner, and at the same time slowly rotating the vertical spindle, A, which carries the scrapers, E, and by means of which the filtering material is suspended in the water, the latter washing out the impurities. As soon as the water runs clear again the rotary action is stopped, and the tap, H, on the bottom of the casing opened to allow the water to run off, and the filtering material to settle, when the filter is again ready for use. The quantity of water which may be filtered before it becomes necessary to clean the fiber depends, of course, largely on its state of impurity, and it is advisable to use as a guide the pressure required to force the water through the filter. This should not exceed from 3 ft. to 4 ft. of water pressure, and it is therefore best to place the funnel about that height above the overflow. At each cleaning a small quantity of filtering material is naturally washed away with the impurities; this amounts to about 10 per cent, which quantity should be replaced by admitting it with the water. For the purpose of washing out the filter it is not necessary to use filtered water, nor is water of any particular pressure required; it may be simply charged through the delivery pipe. If at any time it becomes desirable to entirely empty the filter of the filtering material, water is charged through the delivery pipe or into the open vessel, and the tap, I, at the bottom of the supply pipe, A, is opened, when the fiber will run out with the water. The apparatus can be recharged as described above, and for the complete operation of cleaning one filter, one man only is required for about ten minutes. This filter is recommended by the manufacturers for purifying water for all purposes, a small size measuring only 9 in. in diameter and 15 in. high inside, and carrying only about 1 oz. of filtering material, is specially manufactured as a portable filter for military purposes, capable of filtering over 80 gallons of water per hour; this is apparently a very handy form, and certainly a very valuable addition to the field equipment of an army. We understand that Messrs. Arnold & Schirmer are about to make arrangements for the manufacture of these filters in this country.



PIEFKE'S IMPROVED RAPID FILTER.

The Diamond Rattlesnake.

Of all the snake varieties of which we have yet any knowledge, the diamond rattlesnake, as it is called, seems to be the most deadly. It grows to a length of six feet or seven feet, and is somewhat thicker than a man's wrist. It is armed with the whitest and sharpest of fangs, nearly an inch in length, with cisterns of liquid poison at their base. A terror to man and beast, he turns aside from no one, although he will not go out of his way to attack any unless pressed by hunger. A description of his movements by a traveler who has encountered him states that he moves quietly along, his gleaming eyes seeming to emit a greenish light, and to shine with as much brilliancy as the jewels of a finished coquette. Nothing seems to escape his observation, and on the slightest movement near him he swings into his fighting attitude, raising his upper jaw and erecting his fangs, which in a state of repose lie closely packed in the soft muscles of his mouth. This snake is not so active as the famous copperhead of North America, nor so quick to strike, but one blow is almost always fatal. His fangs are so long that they penetrate deep into the muscles and veins of his victim, who has little time for more than a single good-by before closing his eyes forever. In one instance the fangs were found to be seven-eighths of an inch in length, and though not thicker than a common sewing needle, they were perforated with a hole through which the greenish-yellow liquid could be forced in considerable quantities, and each of the sacs contained about half a teaspoonful of the most terrible and deadly poison.

THE official returns give the value of the tobacco consumed in France in 1882 at 363,500,000 francs. Cigars show a total of 60,500,000 francs; cigarettes, 16,000,000; and chewing tobacco, 9,000,000. The heaviest amount, 278,000,000 francs, was for ordinary smoking tobacco.

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Magnetization of Iron and Steel by Breaking.

At a recent meeting of the Society of Physical and Natural Sciences of Karlsruhe, says the *Karlsruher Zeitung*, Herr Bissinger offered a communication on the magnetization of steel and iron bars when broken in a testing machine. The phenomenon is not brought about by the elongation that accompanies the breakage, but is produced at the very moment of breaking, the two halves being converted into magnets of equal strength. The breaking occurs with a loud noise and strong shock, and the resulting concussion might possibly be considered as the cause of the magnetization. It should be remarked just here that in the testing machine the bars are placed vertically, and that the south pole forms at their upper extremity.

It would be interesting to ascertain whether magnetization would occur equally and with the same intensity if the bars were horizontal or inclined. The maximum of magnetization should occur in cases in which the bar was parallel with the axis of the earth; but the machine owned by Herr Bissinger allows only of a vertical position.

The different tools and objects of steel that happen to be in the vicinity of the bar at the moment it breaks also become magnetized, but to a much less degree.

Sense Culture.

The special culture of the senses is too much neglected by us in this modern busy life. Probably at no previous period of human history has the nervous system generally, and, more particularly, the sense organs, been so severely taxed as they now are, but never have they been less carefully cultivated. This is in part, if not wholly, the cause of the progressive degeneracy of the faculties of special sense, which is evidenced by the increasing frequency of the recourse to spectacles, ear trumpets, and the like apparatus, designed to aid the sense organs. The mere use of faculties will not develop strength—it is more likely to exhaust energy.

Special training is required, and this essential element of education is wholly neglected in our schools, with the result we daily witness—namely, early weakness or defect in the organs by which the consciousness is brought into relation with the outer world. It is not necessary to adduce proofs of the position we take up, or to argue it at length or in detail. The truth of the proposition laid down is self-evident. On the one hand we see the neglect of training, and on the other the increasing defect of sense power. The matter is well worthy of the attention of the professional educators of youth.

Muscular exercise wisely regulated and apportioned to the bodily strength is felt to be a part of education. Sense culture, by appropriate exercises in seeing, hearing, touching, smelling, would, if commenced sufficiently early in life, not merely prevent weakness of sight, deafness, loss of the sense of feeling, and impairment of the sense of smell long before old age, but by its reflected influence on the nutrition of the brain and upper portion of the spinal cord would do much to reduce the growing tendency to paralytic diseases, which are very decidedly on the increase.—*Lancet.*

Sinking of a Large Building.

A curious instance of the difficulties which the peculiarities of tropical soils give rise to when dealing with the foundations of heavy buildings has recently occurred in Georgetown, the capital city of British Guiana. Designed by the government engineer until lately in charge of the Public Works Department of that colony, some erections intended for use as law courts had proceeded to a certain point, when the successor to the office above named discovered that the buildings were bodily sinking, and this—as far as we have been able to learn—was taking place without any settlements or cracks being visible in the walls of the building, and without any disturbance of the surface soil close to them. In fact, it was not easy to detect the immediate cause of the subsidence, but it was ultimately found that at a few yards distance the ground was bulging upward. The present head of the Public Works Department in his report in no way reflects upon the character of the design given by his predecessor to the footings, or on the dimensions of the foundations.

There is nothing, indeed, in these to find fault with, and the difficulty has arisen apparently from the twofold character of the soil in the immediate vicinity of the buildings; that on which the work is erected being of good, solid, unyielding sand, but being surrounded to all appearance by a bed of earth less capable of withstanding either vertical or lateral pressure. The consequence has been that this surrounding belt of earth has yielded upward to the force exerted upon it by the lateral thrust of the squeezed material immediately below the buildings.

Iridium Plating.

Mr. W. L. Dudley has announced before the Ohio Mechanics' Institute that the problem of electroplating with iridium has been solved by employing a suitable solution of the metal and properly regulating the electric current. The solution is kept at uniform strength by using a plate of iridium as the anode. The metal is deposited in the reguline state, and takes a good polish. A buffing wheel that will grind off nickel plating in a few moments only serves to polish the iridium. Thin platinum foil, coated with iridium, retains its flexibility; and if the coating is not too thick, it will not readily scale off.

THE HUDSON RIVER TUNNEL.

After a cessation of about five months, work has been resumed at the New York end of the tunnel. It will be remembered that upon the New Jersey side nothing had been encountered in driving the tunnel but silt, which presented a shell or coating sufficient to hold the air when the pressure was kept near the hydrostatic head; but on this side nothing has been found except sand, and the difficulties presented have been serious and hard to overcome.

Last November, when it was decided to stop work, the tunnel had been completed through this sand to a distance of about seventy feet from the shaft, and a bulkhead of flanged iron plates had been built across the heading just in front of the masonry, as shown by the dotted line in Fig. 2.

To support this bulkhead, heavy timbers were placed vertically across its face, and others at right angles to these, while against the latter beams rested whose rear ends were embedded in the masonry. When the engines were stopped and the air pressure lowered, the incoming sand and water quickly pushed out the calking in the seams and flooded the chamber. In this condition the tunnel was left.

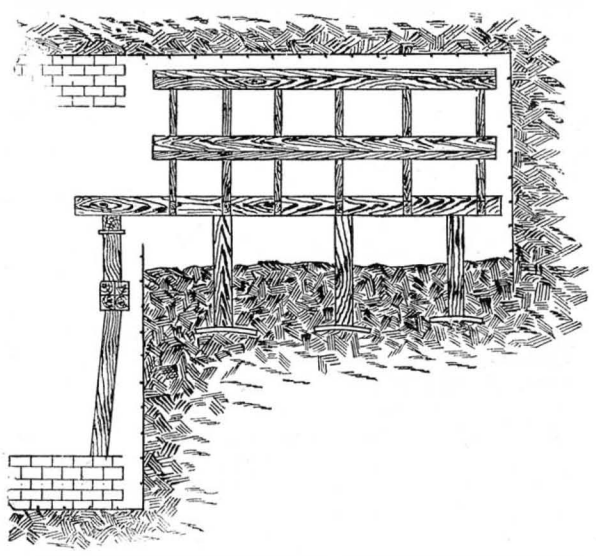

Fig. 1.—HUDSON RIVER TUNNEL.

On the 22d ult., when the engines were started again, the work was found unchanged, and no time was lost in beginning the building of another section. The method now pursued is very simple in appearance, yet requires great care and experience to insure success.

The upper plate of the bulkhead is removed and another inserted horizontally and bolted to the one already in position over the masonry, so that the crown line is continuous. One by one plates are put in ahead of and to the side of the first one, until the end of the section it has been decided to build has been reached, when the bulkhead is commenced and carried down with the sides. A regular system of bracing prevents settlement. The engravings are longitudinal sections, Fig. 1 showing the section when about one-half excavated, and Fig. 2 when all the material has been removed.

As the work is carried down, the upper part of the section forms a segment of a cylinder having a vertical end of iron plates, sides of plates, and the other end open to the working chamber, or finished tunnel. This acts as an inverted basin, beyond the edges of which the water cannot rise.

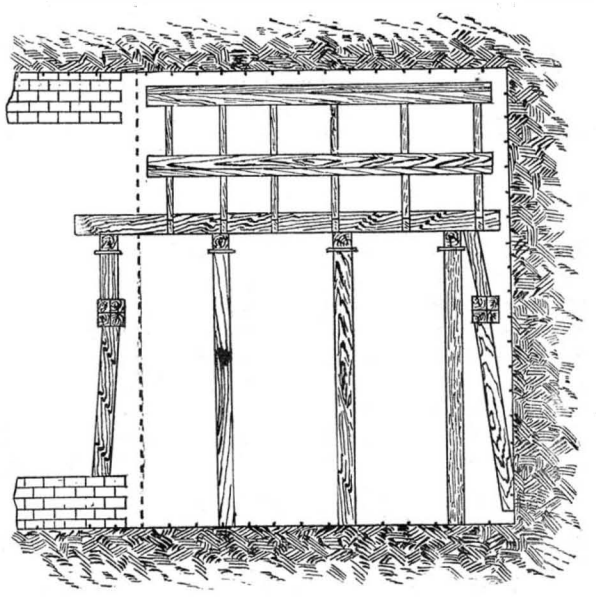

Fig. 2.—HUDSON RIVER TUNNEL.

To support the roof, beams are placed beneath the framing, and rest on plates embedded in the sand, as shown in Fig. 1. When the section has received its coating of iron the masonry of the tunnel is begun, and gradually carried up and around until completed. To prevent the escape of air, every seam is thoroughly calked, either with silt brought from the other side of the river, or with a mixture of Portland cement and sand.

Air is furnished by two compressors built by the Ingersoll Rock Drill Company, and one duplex compressor, built by the Clayton Steam Pump Works.

The north and south tunnels upon the other side of the river have been finished to a distance of 1,550 and 560 feet respectively from the shaft. Work on the tunnel has been resumed and is progressing favorably.

We are indebted to the courtesy of Mr. S. H. Finch, Chief Engineer, for explanations of his methods.

Bleaching of Paraffine.

M. De Molon's patent process of bleaching of paraffine (as described in the *Corps Gras Industriels*) is said to be more rapid and less expensive than the older methods, while presenting the additional advantage of incurring none of the waste which has been alluded to. It consists, in the first place, in the filtration of the rough paraffine, which is subjected in a boiler to the action of lime, there being added about five per cent of its own weight of sulphide of sodium and water. The mixture is let cool in order to allow of the solidification of the layer of paraffine; it is then washed with boiling water and then pressed. The sulphide of sodium may be replaced by ten per cent of lime in powder. After boiling for an hour, the mixture is filtered, and is treated, as above, with amylic alcohol. The residues from these operations are preserved in order to be treated subsequently by an acid—for instance, hydrochloric acid or sulphuric acid. The action of these acids is to form with the base a salt, and consequently to liberate the carbureted oily substances. The paraffine and the amylic alcohol are then set free by the process of distillation.

The inventor of this system remarks that in place of sulphide of sodium and lime other sulphurous combinations could be used. It is further stated that, after the performance of the operations which have been described, the action in a suitable apparatus of sulphuret of carbon, of amylic alcohol, or other dissolvents can be substituted for the filtration by means of animal charcoal, which has hitherto been customary. Care should be taken that the liquid intended to be used in the filtering process should be made as cool as possible. After this treatment has been carried out, the paraffine has only to be filtered and pressed before being delivered to the trade.

Book Cleaning.

Some of the books in the last installment of the Sunderland sale, London, have been ruined by clumsy attempts to clean them. A Terence, with the date 1469, would be the earliest known printed copy, if the date were genuine. But the paper was so grievously rotted by chemicals that the volume was sold for twenty-five shillings. In another copy, so extremely rare that Dibdin only knew it in an imperfect state, and Brunet did not know it at all, the paper had also been rotted in the cleaning, and the book sold for four pounds. It seems a pity that a beginner in the fine art of washing books chose such valuable specimens for his first experiments. In the "Annuaire du Bibliophile" for 1862, M Meray teaches the poor collector how to make a clean and valuable book out of a dirty and ignoble specimen. If a book be greasy, you separate the sheets and dip them in a solution of *potasse caustique*, following up this by a bath of eau de javel, with a fourth part of clear water. A bath of sulphite of soda follows, and it only remains to hang the sheets up to dry on strings stretched across the room. When paper is "cottony" and rotten, a bath in water in which gelatine has been dissolved with a little alum may be recommended. The *Graphic* facetiously adds, however, that it would be extremely interesting to make these experiments on the books of our friends.

Don't be Afraid of Work.

Don't be afraid of killing yourself with overwork, son, is the facetious way the Burlington *Hawkeye* has of counseling young men to thrift. Men seldom work so hard as that on the sunny side of thirty. They die sometimes; but it is because they quit work at 6 P.M. and don't get home until 2 A.M. It's the intervals that kill, my son. The work gives you an appetite for your meals; it lends solidity to your slumber; it gives you a perfect and grateful appreciation of a holiday. There are young men who do not work, my son—young men who make a living by sucking the end of a cane, and who can tie a necktie in eleven different knots, and never lay a wrinkle in it; who can spend more money in a day than you can earn in a month, son; and who will go to the sheriff's to buy a postal card, and apply at the office of the street commissioners for a marriage license. So find out what you want to be and to do, son, and take off your coat and make success in the world. The busier you are, the less evil you will be apt to get into, the sweeter will be your sleep, the brighter and happier your holiday, and the better satisfied will the world be with you.

IT is not uncommon to meet in our streets peddlers of kerosene going from house to house vending their illuminating fluid from a can. In Paris the electric stored light is carried about the streets like kerosene here, and it is said to have become a favorite way of illuminating houses on social and official occasions. The accumulators are carried in a vehicle, which is stationed in front of the house, and electric wires are conducted into the building through the windows. Incandescent lamps are placed in the ordinary candelabras, and the fitting of the most complex lighting is an affair of but a very short time.

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On Sea-going Torpedo Boats.

At a recent meeting of the Institution of Naval Architects, a paper was read by Mons. J. A. Normand, in which was advocated the extended use of sea-going torpedo boats, of from fifty to eighty tons displacement, having a maximum speed of eighteen to twenty knots, capable of steaming at least 1,000 nautical miles at ten or twelve knots, costing from £8,000 to £11,000, and manned by a crew of from ten to fifteen men. The importance of vessels of this class in future warfare was then referred to, and the consequences that would follow on their adoption. These were: (1.) No ironclad, no squadron or fleet, no cruisers (unless cruisers should attain the speed of torpedo boats), could navigate in a sea of moderate dimensions, such as the Channel or Black Sea, belonging simultaneously to powers at war, unless they should be escorted by sea-going torpedo boats equal in strength to those of the enemy. (2.) Military ports situated in those seas, or nearer than 200 or 300 miles to the enemy's shores, would be rendered useless as stations for ironclads or cruisers. For instance, supposing a war between England and France, this would be the case for Cherbourg, Plymouth, Portsmouth, and Sheerness. Cherbourg and Plymouth could then be assimilated to two military ports, whose entrances should be under the fire of each other, shot being here replaced by torpedo boats. (3.) Powers not having military ports sufficiently far from the enemy's shores would be actually deprived of the use of their navies, with the exception of those vessels stationed in foreign neutral waters, unless they could force the blockade of sea-going torpedo boats with a fleet of the same kind equal in strength. The above propositions are founded on the hypothesis that one squadron of sixty to eighty sea-going torpedo boats, equal in men and cost to one ironclad, are stronger than this ironclad by daylight, and *a fortiori* at night, even when reduced to half its number, the other half having left to coal and reprovision itself. Could sea-going torpedo boats be coaled at sea by means which are yet to be found, or could they, by such means as the use of liquid fuel, have their time of steaming doubled, their importance in warfare would be immensely increased. No second-class torpedo boats could replace boats of this kind, because they cannot stand a gale, nor can they then be lowered or shipped, so that the enemy can escape the attack of small torpedo boats by taking advantage of bad weather. The question now is, are torpedo boats of such small displacement as from fifty to eighty tons really sea-going? If they are not, can they be made so? Time and experience will show, but we already know that with their steel deck and hatchway coverings they can stand very bad weather. In an appendix was given the results of the official trials made last summer at Cherbourg of the sea-going torpedo boat No. 60, the first of a series built or building by the author for the French Government: Length of hull at load line, 108 ft. 2 in.; breadth, extreme, 10 ft. 10 in.; diameter high-pressure cylinder, 12·60 in.; diameter low-pressure cylinder, 20·48 in.; stroke, 14·96 in.; heating surface, fire-side, 816 square feet; grate surface, 19·3 square feet. Full speed three hours' trial. The boat was complete, with launching tubes, compressing engines, air reservoir, six 19 ft. Whitehead torpedoes, 2½ tons coal, two Berthon collapsible boats, no masts. Displacement, 43 tons; mean speed, 20·62 knots; consumption of coal during the three hours, 1·58 tons; consumption of coal per hour, 0·53 ton; indicated horse-power, about 500; revolutions per minute, 328·5; boiler pressure, 132 lb.; air, 3⅜ in..

In the discussion which followed, several speakers remarked on the extremely low rate of consumption of fuel, and desired that further information should be supplied in regard to the engines and boilers, but more especially the latter. Mr. Samuda thought that Mons. Normand was entirely wrong in his view that a naval contest at sea could ever be carried on with cruisers and torpedo boats of from fifty to eighty tons. Such boats might be useful as scouts, but for the actual work at least 1,200 or 1,400 tons displacement would be required, and he questioned whether a protection of armor would not be necessary, in which case 2,500 tons displacement would be nearer the mark. Admiral De Horsey confirmed Mr. Samuda's opinions, and thought that boats capable of steaming only six hours would be of no value at sea. What was wanted was a certain size of torpedo boat for harbor work, a larger size for the Channel, and larger again for the Mediterranean; but for the ocean he submitted that no torpedo boat was of any use whatever. Mr. White, however, pointed out that the boats mentioned in the paper, though only of 50 to 80 tons displacement, were practically unsinkable, while they were self-supporting under sail at sea, so that the fuel would not be used till the enemy was actually in sight, and operations about to commence. Reference was made to the recent bombardment of Alexandria, and to the fact that if the Egyptians had been provided with torpedo boats of the class mentioned in the paper, the bombardment would in all probability not have taken place, as our fleet would have found it very difficult to stay off Alexandria at all.

Food Preservatives.

The action of very diluted nitromuriatic acid (aqua regia) on meat and other animal substances has been recently studied by Signor Pavesi, and he finds the substance an excellent preserving agent; meat in pieces of about 1 kg. kept in the liquid in wooden vessels remains unaltered and savory for years. The meat treated may also be dried at 15° to 20° without undergoing change, apart from a diminution of volume and the appearance of a brown color. Put for a few hours in water, the meat recovers its original softness and natural color. The proportions of the acids in the preserving liquid are not given. The method is also adapted to preservation of animal substances for scientific purposes.

A new set of experiments by Dr. J. Bersch on the preservation of must by means of salicylic acid are alluded to in a recent number of *Biedermann's Agricultural Journal*. The author of these observations has found that *fifteen* parts of salicylic acid in 200,000 parts of must is a sufficient quantity to entirely prevent the formation of mould or mildew. M. A. Dalpiaz not very long since made known the results of his experiments, which were begun as early as 1875, with the view of discovering some substance of not too expensive a nature which should enable us to preserve fruits and vegetables. He at last found what he desired in salicylic acid, and published a note on the subject in the eighth volume of the *Chemisches Centralblatt*, third series, p. 670, in which he treats specially of the preservation of fruits.

A solution is prepared with 2½ to 3 grammes of salicylic acid, and 100 to 500 grammes of sugar in one liter (about a quart) of water. The fruit to be preserved is simply placed in this fluid, and the vessel covered over tightly with a sheet of ordinary writing paper. No other precautions are necessary.

M. A. Dreher writes that he has taken 0·25 gramme (about 4 grains Engl.) of salicylic acid daily for the space of two months in beer, without experiencing the slightest inconvenience, and possibly with some benefit to his health, and as this is the largest quantity which should be used for the purpose of preserving beer from secondary fermentation and acidity, etc., he is glad to confirm Professor Kolbe's experiments in this direction.

M. R. Jacobi has lectured at Cologne, at the Union of Arts and Trades, on the advantages of salicylic acid in beer, and recommends that the quantity used should not exceed one part of salicylic acid in 5,000 parts by weight of beer for ordinary purposes. This is, he says, the largest quantity requisite for preserving beer under the most trying circumstances, and even for export in barrels. A person must drink 10 pints of beer daily in order to consume 15 grains of salicylic acid, and as most people drink far less than this, the introduction of salicylic acid, rigorously weighed, cannot prove in any way prejudicial to public health.

MICE-GIRDLED TREES.

At a recent meeting of the Elmira Farmers' Club, several members gave their views in answer to the inquiry of an orchardist who had a number of trees girdled by rabbits. In answer to the inquiry, and in allusion to the remedy of making a connection of the bark above and below the denuded part by inserting shoots, a member said it was next to impossible to have this mode succeed. Others spoke of the difficulty in making the trees live. As frequent inquiries are made on the subject, we repeat in substance the mode described in the *Country Gentleman* many years ago, which we have always found easy and certain, even for trees several inches in diameter. The process is exhibited in the accompanying cuts. Fig. 1 represents the trunk of a tree which has been girdled; Fig. 2, the twigs or shoots inserted to make the connection; and Fig. 3, a section showing the position of the inserted shoots. The twigs may be

Fig. 1.

Fig. 2.

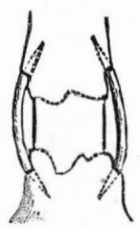

Fig. 3.

from a fourth to half an inch in diameter; the latter size will be best if the tree is large enough to hold them. They are sharpened to a wedge at each end, and the openings made with a narrow chisel to receive them. If the girdled part is low down, it will be necessary to dig away some of the earth, to make room for the chisel to enter the upper part. The twigs are first bent like a bow for entering, and then brought nearly straight when in place. It will be necessary to bind them to keep them firmly in their places. Then cover with grafting wax the two points of insertion. We have always done this work in spring before the buds opened, but if well performed, it would doubtless succeed later.

Some years ago a gentleman who had a large pear orchard of some thousands of trees a few years old called on us early in spring and said he had met with a great loss—the mice had girdled 1,200 trees in the course of two or three days under a March snow, where he had permitted weeds and grass to grow. They were, as he said, "hopelessly ruined," and the loss was at least $3,000. We assured him that he need not lose them, and explained to him the above described mode. "But I have no skilled grafter," said he. We told him that any man who was handy with tools could do the work—a common carpenter, for instance. He accordingly went to work and employed three men. They could each finish sixty or eighty trees in a day, with four shoots to each tree. Nearly all survived and grew, as well as the trees which remained uninjured, except some sixty out of the twelve hundred, and these were set by a careless bungler. Where the work was well done, they all lived. In a few instances only two shoots were inserted, but the want was supplied in a year or two by inserting the upper ends of suckers which sprang up below.

In the orchard alluded to at the Elmira Farmers' Club, the trees had been set out the previous year, were still quite small, and the rabbits had girdled them a foot or more up while running on crusted snow. The mode recommended by some of the members, of cutting down below the girdled portion, and rubbing off all but the largest shoot springing up from the grafted portion below, may be the easiest and best, and in some instances it would furnish a new and handsome tree almost as soon as if no injury had been done, but there need be no difficulty in making the described connection if small shoots are inserted, with a narrow chisel to make the incision, and with the whole well bound together and waxed.

The best treatment is prevention by keeping the orchard clear of weeds and grass, and, if necessary, embanking in autumn with smooth, solid mounds of earth.

Progress of the Telephone.

At the annual meeting of the Bell Telephone Company, held at Boston recently, the reports made showed the rapidity of the development of the business the past year. The total earnings for the year amounted to $1,576,031.57, against $1,001,924.91 the previous year. The expenses were $603,987.29, against $439,862.76 the year preceding; net earnings for the year, $972,044.28; balance of income from previous year, $126,034.58; total, $1,098,078.86. The total of the previous year was $606,555.01. Dividends paid, $595,000; carried to surplus account, $334,997.32; balance of income account, $168,081.54; total, $1,098,078.86. The increase of interchanges of telegraphic union doubled last year. The sales of instruments for export decreased and are likely still further to decrease, as foreign countries are making good instruments of their own. The royalties from manufacturers now go to the manufacturing branch.

Local companies in New York, Chicago, San Francisco, and Boston are all paying dividends. All of the Dominion of Canada, exclusive of Newfoundland, is supplied by the American Bell Company, and dividends are to be expected from Canada. The legal expenses of the company have been heavy during the year. The report of the treasurer congratulates the company on the fact that the courts have decided that the Dolbear condenser telephone receiver, so called, infringes on the Bell patent, and an injunction has been issued; also upon the opinion of Justice Gray that the Bell patent has all the breadth that has been claimed for it, and covers microphones and instruments that employ electrical undulations. The People's Telephone Company, using a carbon transmitter, has set up lines in New Jersey, and the report says that an action on the case called forth the most careful examination that has ever been given to the principles of the various instruments, and gives additional proof that the microphone and other things claimed under the Bell patent are authorized. The case has since been decided in favor of the Bell Company. The underground wires in Boston have been found to transmit distinctly only for short distances, and it will be necessary to devise further improvements before they can be made available to any extent. It was voted that the capital stock of the company be increased from $7,300,000 to $9,800,000, and that new shares be allowed on the basis of one new share to each holder of the old ones.

Remarkable Meteor in Italy.

Advices from Rome state that on the 16th of February some peasants working in a field near Brescia were startled by hearing a loud report like thunder. Looking up they saw the clouds torn open, and a large body followed by a train of bluish smoke hurtling through the air over their heads with the noise of an express train. The aerolite buried itself in an adjoining field, the fall causing a shock like that of an earthquake. It was felt ten kilometers away, while the report was heard at Verona and Piacenza, many miles distant. When they had recovered from their fright, the peasants hurried to the spot, and found a clean hole about three feet deep, running in an oblique direction from north-northeast; and on digging down they came to a solid block, in the form of a truncated cone, weighing from 400 to 500 pounds. The surface, which was still hot, and emitted a sulphurous smell, was covered with a greenish-black crust, full of small holes, such as would be made by finger-tips in a soft paste, which may have given rise to the report that one of the fragments bore the impress of a hand. The proprietor of the clover field in which the aerolite fell flew into a rage at his crops being trampled down by people coming to see it, and broke it up, when it was carried away piecemeal. So he gained nothing but damage to his fields, while those who picked up the pieces found a ready sale for them, one man getting as much as 7,000 francs for a lump that weighed twenty-five pounds. On a subsequent search by Professor Bombicci, of Bologna, several pieces of scoriæ, apparently detached from the aerolite in its flight, were found in the neighborhood.

A Disinfective Laundry Blue.

Mix together 16 parts of Prussian blue, 2 parts of carbolic acid, 1 part of borax, and 1 part of gum arabic into a stiff dough. Roll it out into balls as large as hazel nuts, and coat them with gelatine or gum, to prevent the carbolic acid from escaping.

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American Competition in the Australian Colonies.

The following is an extract from a letter newly received by one of the leading colonial houses in Birmingham from their Melbourne correspondents, which we copy from the *Ironmonger* (London):

"We call your attention once more," says the writer, "to the enormous increase in the number of articles we are buying from America. A few years since some half dozen articles were about all we ordered of American make; now, as you will see by the indents we send you, the items specially ordered of American make are to be counted by hundreds. This increase is still maintained, and is, indeed, still growing. Your English manufacturers would do well to take a lesson from their American rivals. The American goods exactly suit the requirements of the market. The timber they have will always command a certain trade, but why should they excel English makers of shovels, axes, picks, and all classes of edge tools? It is annoying to those of us who have English sympathy to see so much trade go away from the old country. The general characteristics of American goods, as contrasted with home-made, are: quality more reliable, better finish, not an ounce of unnecessary material, better packing, and the articles themselves thoroughly adapted to the use to which they are to be put. Some of the things they make have been found unsuitable, and once ordered have never been repeated. Their cutlery will not bear comparison with the English make, and the same may be said of their plated ware. In wire-work as well as cast and wrought iron hollow ware England carries all before it. In all the cheaper kinds of cutlery Germany is becoming a very strong competitor, and also in steel toys and many other lines. Your English makers must bestir themselves, or they will certainly lose the larger part of their Australian and New Zealand trade."

[In addition to the reasons for the impetus given to trade in our products in the English colonies, we have an idea that one of the causes which has benefited our export traffic very much is the fact that our manufacturers and merchants advertise their wares in the export editions of newspapers which are circulated quite largely of late in the English colonies, South American countries, and Spanish islands.—ED.]

An Aged Inventor Gone.

The old fashioned pins used by our grandmothers were made by sharpening a bit of wire and twisting another bit as a head. They were valued more than the much finer ones made now. One of the first lessons of an honest childhood was in the words, "It is a sin to steal a pin." Economy was to be shown by carefully saving these little instruments, and they were commonly kept in service till they were actually worn out. Even among wedding presents, "a half a thousand of pins" was not a gift to be despised.

As recently as 1836 it occurred to Dr. J. J. Howe, that pins might be made cheaper and better by machinery than by hand. He interested a New York merchant, named Jarvis Brush, in his ideas to such an extent that the latter furnished the capital for proceeding with the experiments; and when, in 1840, the American Howe Pin Company, of Birmingham, Conn., was founded, Mr. Brush was at its head, and sent out the first solid headed pins the world ever saw. The new business increased so rapidly that in the next ten years it secured a monopoly of the pin trade, and manufactured nearly all sold in the United States, besides exporting large quantities to Europe.

Hundreds of tons of copper and steel were annually consumed in the manufacture, and numerous improvements were made until the modern silvered and polished pin is an elegant work of art compared with the far more costly but clumsy affair of fifty years ago. One of Mr. Brush's most useful inventions was for sticking the pins in paper, an operation that had been previously done tediously by hand; a few being inserted at a time, and six dozen papers being regarded as a full day's work. This he superseded by self-acting machinery, dispensing with numerous manual operations, and enabling one hand to stick one or two hundred dozen papers a day, and to do the work better than it had formerly been done.

In 1850 Mr. Brush retired from the active management of the pin company, but remained a director for life. Having accumulated a handsome fortune, he spent his declining years very happily with his only son, Prof. George J. Brush, the eminent mineralogist and executive officer of the Sheffield Scientific School, in New Haven. Mr. Jarvis Brush died April 10, after a brief illness of four days, with pneumonia, and his remains were interred in Greenwood Cemetery. His age was 86 years; but such were his active and companionable habits that he seemed much younger than was really the case. Like many other inventors, only perhaps in a higher degree, he was genial as well as useful, and courteous as well as clear headed; and this no doubt had its share in prolonging his days.

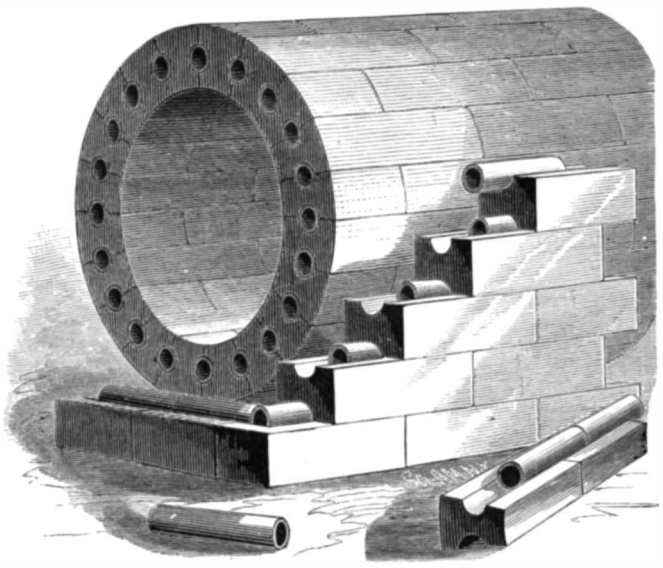
THE *Lancet* thinks that if children would wear woolen next the skin, and wear longer clothing, suspending it from the shoulders, we would hear more of boisterous health and less of back aches and pains.

IMPROVEMENT IN TUNNEL AND HOUSE BUILDING.

We give an engraving showing an improved method of building brick structures, applicable to general house building, culverts, tunnels, vaults, sidewalks, walls for tanks, cisterns, and wells, and many other purposes.

The device, as will be seen by reference to our engraving, consists of longitudinally grooved blocks of suitable material, preferably such as the first quality of strong brick is made of, and a tube of the same material laid in the groove and breaking joints with the blocks. This tube is strongly bound in the block by the cement, which tends to expand so as to compress the tube and hold it firmly in its place in the block.

This construction insures hollow walls of the most desirable form, which in the case of buildings may be used in summer for cooling and in winter for warming. An arch built in this way is as strong when completed as an old arch. It will be noticed that the tubes are supported on all sides, and at the same time serve as a perfect key to retain the blocks in position.



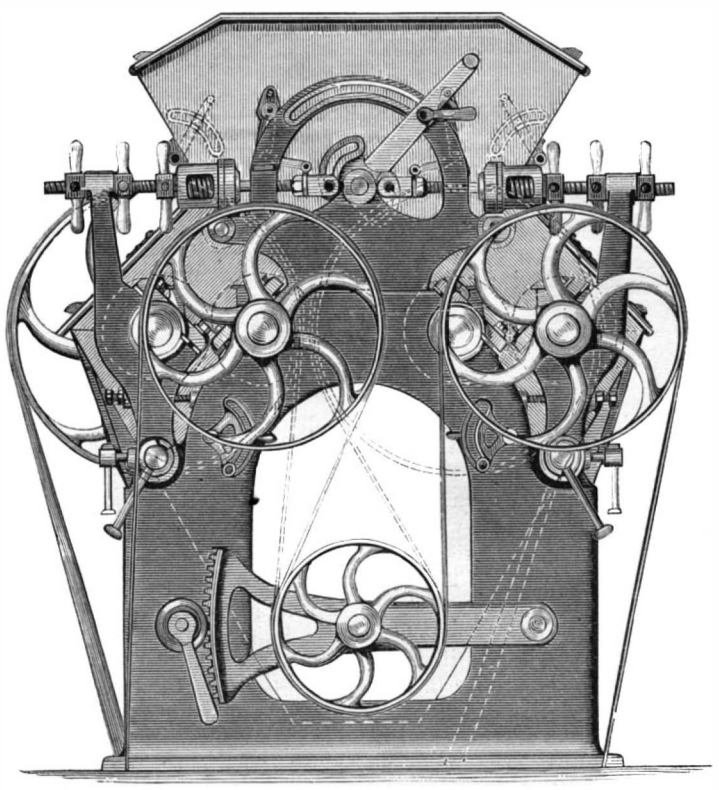
BRYANT & TOSTEVIN'S IMPROVEMENT IN TUNNEL AND HOUSE BUILDING.

The inventors of this system of building claim that they can put in a railroad tunnel of this material cheaper than a deep cut can be made, and at the same time land slides will be prevented.

Messrs. R. T. Bryant and David Tostevin, of Council Bluffs, Iowa, are the patentees of this invention.

AUTOMATIC FOUR-ROLLER MILL.

We are indebted to the London *Miller* for the following description and accompanying engraving of a new roller mill, which is being manufactured by Mr. F. Nell, of London, and represents the latest example of a machine of this class.



AUTOMATIC FOUR-ROLLER MILL.

It will be seen from the illustration that the mill is driven by belts, but gear is provided if preferred. The outside rolls are the slow, and the inside rolls the fast, both sets being operated by belts, which run over a tightening pulley, shown in the center of the lower part of the engraving, regulated by a lever, shown on the left of the engraving, in connection with a ratchet. The following are some of the improvements comprised in this machine:

On each side there is a swing arm, worked by a lever and cam, shown in the center of the upper part of the engraving. This lever has a double object: it throws out the two outer rolls and shuts off the feed simultaneously, and by reversing the lever it brings back the two rolls again and also the feed. At the bottom of the swing arms is placed a set screw, which prevents these arms being brought so close as to allow the rolls to touch, the set screw being adjustable at will. Underneath the driving pulleys will be observed another lever, which is only used, should the brasses at all wear, for the purpose of setting up the journals.

On either side of this lever is a quadrant which regulates the brushes under the rolls, used to keep the latter clean. While the lever acting upon the arms opens and shuts, there is still a further adjustment of the feed made by the two quadrants on the hopper shown on each side of the lever, and which adjust the feed to whatever nicety is required. When the feed adjustment is once set it requires, it is stated, no further interference with from one week's end to the other, the lock nuts preventing any alteration in the position of the rolls. A box hopper is provided to prevent the products from the rolls coming in contact with the iron work of the machine. The rolls may be smooth or corrugated, as may be required for the purpose for which they are to be used, and when they are corrugated, scrapers are used instead of brushes for keeping them clean.

Genesis of a New World.

On a beautiful summer's night, August 22, 1794, Jerome and Lefrançais de Lalande noticed a star in Aquarius, which they estimated of the 7½ magnitude. Six years later they thought it of the 8 magnitude. In appearance it resembles a star which is not exactly in the focus of the telescope. Herschel had observed it in September, 1782, and recorded it as an admirable planetary nebula, very brilliant, small, and elliptical. Lord Rosse and Lassell perceived that it was surrounded by a ring, which gives it somewhat the appearance of Saturn. The spectroscopic observation of Huggins indicate that it is a gaseous mass, in which nitrogen and hydrogen predominate. Most of the other planetary and annular nebulæ give similar results. In 1871 and 1872 Brunnow, the Irish Astronomer Royal, measured its parallax and concluded that its distance is more than 404,000 times as great as that of the sun, and its diameter is probably greater than that of the entire solar system. This would make its volume more than 338,896,800,000,000,000 times as great as that of the earth. We have thus before our eyes a new system, which is probably undergoing the process of condensation through which our sun and its attendant planets passed hundreds of millions of years ago.—*L'Astronomie.*

The Electrical Transmission of Power.

In view of the claims of electricians to be able to distribute power as well as light, by means of wires charged with electromotive force, it is right, says the *Journal of Gas Lighting*, to take account of the results of a recent course of experiments made in Paris upon the electrical transmission of power. So long ago as October, 1881, M. Marcel Deprez declared at the International Congress of Electricians that the economic duty of two dynamo machines connected for the transmission of power was 65 per cent. That is to say, that if 100-horse power were absorbed by one machine, 65 horse power would be given out by a machine receiving the current from the first.

This assertion, like so many others emanating from electricians before and since that time, was accepted with enthusiasm, and has formed the basis of all the wild projects since mooted for the utilization of so-called natural forces for industrial purposes. A French syndicate has, however, put the system of M. Deprez to a practical test in the workshops of the Northern Railway Company in Paris, under the direction of M. Tresca. The result is disastrous to the assumption held since 1881; for M. Tresca has been unable to obtain a useful duty of more than 33 per cent.

In these experiments it appears that 6·21 horse power was put into one machine revolving at the rate of 590 turns per minute, and connected by wires (corresponding in length to 8·5 kilometers) to another machine making 365 revolutions per minute, and giving out 2·03 horse power upon the brake. This amounts to a useful duty, for the transmitting medium, of 32·7 per cent; the rest being lost by the way. It evidently lies with M. Deprez to make good his assertion of 1881, or to confess to something more than an error of judgment. It is even doubted by the *Revue Industrielle* whether M. Tresca's results, small as they are, could be relied upon in the case of a system of distribution established out of doors in the ordinary way, and with the usual liabilities to waste through bad insulation and insufficient connections. At any rate, the claim of electricians to the present possession of means for the economical distribution of power is seriously prejudiced by these statements.

FROM a study of the maximum temperatures naturally occurring, Mr. L. Liebermann says that a mineral oil, the flashing point of which exceeds 60°, may be safely used in all parts of Europe.

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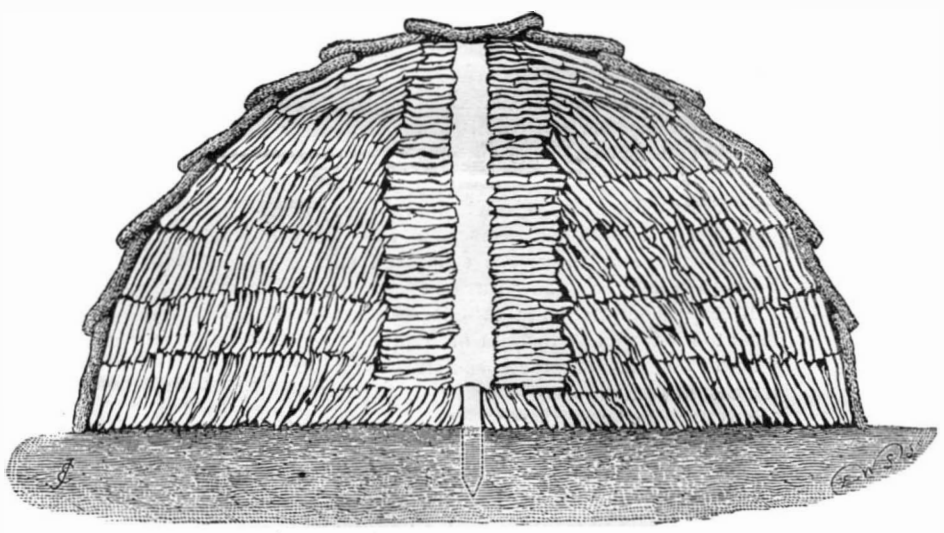
MANUFACTURE OF CHARCOAL.

Inquiries having been from time to time made regarding the production of charcoal for gardening and other purposes, the following simple method, which has been successfully carried out on a large estate, and by which the very finest charcoal is produced, may be interesting if not useful to some of our readers. As now conducted, charcoal is prepared by two different methods.

One is that of placing the wood in an iron cylinder, set in brickwork, and surrounding with fire; and the other, by piling the wood in a heap, covering with turf, and setting on fire; but as the latter method is that generally adopted, we purpose giving a description of the mode of operation. Select a piece of ground sheltered from the prevailing winds, and to which easy access with wood can be obtained. A hut or temporary shelter of some kind should also be provided for the men engaged at the work, as during the period of burning constant attention is required, both day and night.

The quality of wood used is not of special importance, although charcoal produced from ash, oak, or beech is of superior quality to that obtained from most other woods, and may consist of firewood, or any unsalable pieces of timber that may be come across in the general course of thinning. The wood is sawed into pieces two feet in length, and these again split if required to about three or four inches square, until a sufficient quantity has been cut up for the pit, after which the building of this is proceeded with in the following manner:



A CHARCOAL PIT.

The pit is made of a conical shape, 21 feet in diameter and 9 feet in height. A strong stake is driven into the ground, the top of which is left protruding about 12 inches; around this are placed small pieces of dry ash or pine of a similar length, and standing as close to the upright stake as possible. Another layer is formed in the same manner, and so on until a circle of about four feet in diameter is obtained. A circle of one foot in diameter, and having the top of the stake formerly driven into the ground as center, is next made by placing the wood horizontally side by side on the upright pieces, laying others on these in a similar manner until the pit is of the required height, thus forming a sort of chimney, by means of which the pit is fired; the wood used here being dry pieces of ash 24 inches in length, but split rather smaller than the ordinary pieces. Outside this the wood is placed on end and reclining inward, this being continued until the pit is of the required size.

The top half of the pit is now carefully examined, and any crevices between the wood are packed full of small pieces of turf and sawdust to exclude the air. The pit is then covered with newly cut turf, beginning at the base and working toward the top, each row of turf overlapping by a few inches the previous one, the circular hole or chimney being left open for firing. The best turf for this purpose is that grown on loamy soil, that from clay being too stiff, and leaving a residue after burning of clods instead of fine soil.

The turf may be cut of any convenient length, but not over a foot in width, the quantity required being about three loads. The pit is next fired by dropping a quantity of burning wood and some dry pieces of pine or ash into the opening left at the top. After having become thoroughly lighted the top turf is put on, which completely shuts up the chimney when the process of charring commences.

During the period of burning constant attention is required day and night, more especially should the weather be stormy, for the wind blowing for some time from one point generally causes that side to burn very rapidly and "flat" into a hole; should this occur the hole must at once be filled with knotty logs, which should be laid aside for this purpose when splitting the wood, and recovered with turf, any crevices being carefully filled with sawdust to exclude the air. During mild weather less attention is required; the pit burns uniformly all over, and produces the best charcoal.

The time required in burning varies from seven to nine days, much depending on the state of the weather, mild requiring the longest period. As the charring proceeds the turf gradually disappears, until only a slight covering of burnt earth remains, at which point the pit is reduced to about half its original size. When cool the pit is ready for being opened, the charcoal being extracted by means of a light rake resembling a drag, but with much finer teeth; and after becoming thoroughly cool, is stored in a dry shed until required for use. By the above method the very finest charcoal is produced, and of superior quality to what is generally sold. The accompanying illustration represents a section of charcoal pit ready for firing.

Properties and Uses of Charcoal.—The principal use of charcoal is for combustion, for which purpose it is found not only cleaner to use, but also productive of greater and more lasting heat than most other combustible matters, and therefore it is of inestimable value for cooking purposes.

Great care should be exercised in the using of charcoal, as during its combustion carbonic acid is formed by the union of the oxygen of the air with carbon, which acts upon the human system as a powerful sedative poison. It is of frequent use in the garden for potting purposes, vine borders, flower beds, etc., and in the transmission of bulbs nothing is better for packing than charcoal dust. The consumption of charcoal for gunpowder making is also very great, preference, however, being given to that produced from certain kinds of wood. Charcoal is a good disinfectant, tasteless, inodorous, and full of pores, nearly 100 inches of gaseous ammonia being absorbed by a cubic inch of fresh charcoal.—*A. D. Webster, in The Gardeners' Chronicle.*

PHYSICS WITHOUT APPARATUS.*

1. *Conductivity of Sound by Metals.*—If we hold a watch by means of a pair of tongs, and place the handle of the latter closely against our ear (Fig. 1), we shall hear the ticking of the timepiece as distinctly as if it were itself being held to the ear. If we remove the tongs, leaving the watch in the same place, we may ascertain, through the diminution in sound, how excellent is the conductivity of metals for the latter.

This experiment explains the role of those wooden rods that have been devised for the use of deaf persons, and at one extremity of which the speaking is done, while the other extremity is placed in the ear of the person afflicted with deafness.

Fig. 1.—CONDUCTIVITY OF SOUND BY METALS.

Fig. 2.—EXPERIMENT ON THE PRINCIPLE OF INERTIA.

2. *The Principle of Inertia.*—The experiments which serve to demonstrate this principle are innumerable, and we have already cited a large number. The one represented in Fig. 2 is an amusing one to try, and gives a means of uncorking a bottle without a corkscrew. If we take a well-corked bottle of wine, beer, or other gaseous liquid, and, after protecting the bottom with a cushion formed of a napkin, give it several strong raps against a wall, the liquid, by virtue of the principle of inertia, will drive out the cork; and sometimes even, especially if the experiment is tried with beer or carbonated water, the cork will come out with such force that a portion of the liquid will spurt out at the same time, and, to the amusement of the operator, fly over the curious spectators of "Physics without Apparatus."

It is asserted that it is not rare at St. Galmier to see the waiters in the hotels of that place uncork bottles of carbonated waters in this way, by striking them against the floor. But, just as M. Jourdain made prose without knowing it, so these waiters are assuredly not aware that they are performing an operation in physics, and giving a demonstration of the principle of inertia.

3. *An Experiment in Repulsion.*—Toward the end of the year 1875, says M. Le Goarant, in *La Nature,* I performed an experiment that I have never seen described in print.

If we pour some pure water into any vessel, a bowl for example, and allow the melted wax from a lighted candle to fall drop by drop on to the surface from a distance of six to eight inches, the wax cools suddenly in the form of light hemispheres.

If the end of a slightly moistened piece of soap be dipped into the water, in the midst of the waxen bodies, these latter will all be suddenly repelled, as if by an invisible puff of air, against the sides of the vessel, to which they will remain adherent. By blowing them they may again be driven to the center of the water, and the experiment may be repeated two or three times; but, after that, it no longer succeeds, because of the small proportion of soap that is dissolved in the water. In order to begin again, the water must be removed.

The experiment is very easy to perform. It is probable that the cause of this so marked repulsion is due to the rapid solution of the soap in the water. The soap at first stays on the surface, and after the water has dissolved some of it the solution operates through the mass and not only on the surface.

I have tried other bodies, such as essences, oil, etc., and found the effects to vary with the material employed.

* From *La Nature.*

The Phosphorescent Flame of Sulphur.

Heumann, having raised the question whether phosphorus among the metalloids was the only one which underwent slow combustion at a low temperature, becoming luminous, has answered it satisfactorily by experiment. He finds that sulphur shows this phenomenon very well, though of course at a temperature higher than is required for phosphorus. If a heated rod of glass be dipped in pulverized sulphur, it becomes covered with the fused material, which takes fire. If now the blue flame be blown out, the sulphur still continues to burn, but with a whitish flame visible distinctly only in the dark.

This white phosphorescent light is seen much better when the sulphur is heated rapidly to 180° on a plate in the interior of a metallic air bath. White flames ten to twenty centimeters long flicker through the entire box. By regulating the gas this slow combustion may be continued for an hour without the appearance of the blue flame. Various kinds of sulphur were tried with the same result. Moreover, many compounds of sulphur act in the same way; cinnabar, antimonious sulphide, arsenious sulphide, aurum musivum, sodium t iosulphate, potassium xanthate, sulphurea, all showing the white flame. The odor emitted when the sulphur thus burns is peculiar, recalling that of hydrogen persulphide, camphor, and ozone at once, and is the odor ordinarily ascribed to sulphur vapor. On examining it closely, however, nothing could be recognized in it but sulphurous oxide.—*Ber. Berl. Chem. Ges.*

Cure for Lumbago.

A correspondent in Smyrna, Turkey, sends the following, and states that it is reliable: Take a piece of oilskin cloth, such as we use to cover tables, but of a soft, pliant kind, sufficiently large to cover the loins; place it over the flannel shirt, and bandage yourself with a flannel bandage; profuse perspiration will ensue on the loins, and you are quickly rid of this wearisome complaint.

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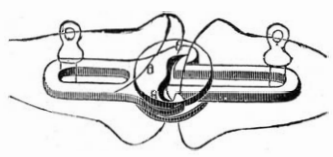
RECENT INVENTIONS.

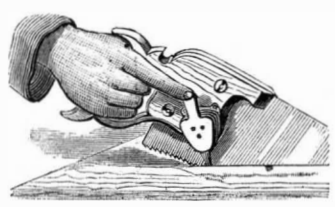
Improved Car Coupling.

The improved car coupling link shown in the engraving is arranged so that it will uncouple itself automatically should one or more cars leave the track. This link is coupled in the usual manner, by means of the ordinary coupling pins. The invention consists of a slotted piece provided at one end with an enlargement having inwardly projecting hook projections, and of a U-shaped piece provided at the ends of the shanks with outwardly projecting hook projections passing within the hook projections on the other piece. The outer ends of the drawheads are recessed, as shown, to receive the circular plates or disks. If at any time a car runs off the track and the drawheads are brought at an angle to each other, the free ends of the U-shaped piece are contracted, and are drawn out of the recess behind the projections in the other half of the link, and the two parts forming the link will be disconnected and the cars will be uncoupled. This is of great importance, as the car that runs off the track cannot draw off the other cars. This invention has been patented by Mr. Henry Keller, of Corpus Christi, Texas.



Novel Hand Saw Attachment.

This invention consists in a device for forcing a current of air down upon the board being sawed, for clearing away the sawdust from in front of the saw to show the line being followed in sawing. The inventor attaches a small pair of bellows to the handle of the saw in such manner that it may be worked either in the act of operating the saw, or by the movement of one of the fingers of the hand. The exit pipe of the bellows is carried down near to the teeth of the saw, so that the current of air forced from the bellows will strike the surface of the board at or about the point where the saw teeth rest in contact with the board, so that it will clear away the sawdust at that point, so that the line being followed in sawing will not be covered up or obscured by the sawdust. This useful invention has been patented by Mr. Henry Winter, of Hanover, Ill.



Improved Animal Poke.

The engraving represents an improved animal poke recently patented by Mr. B. S. Thomas, of Waverly, Ill. This invention is designed to prevent cattle from running down or jumping fences, fighting, pushing other stock, drinking their own milk, running through brush, and which at the same time permits them to graze and drink at will. The invention consists in a poke hinged to a board which can be fastened by means of straps on the forehead of the animal. On the board is secured a spring, the lower end of which terminates in a prong passing through the board. When the animal strikes against a fence or another animal with its head, the spring prong will be forced through the aperture in the board, and will prick the animal's nose. The spring immediately withdraws the prong as soon as the pressure on the poke is removed. All communications relating to this invention should be addressed to Mr. William Coe, Waverly, Ill.

Antiseptics and Volatile Products of Decay.

An investigation of antiseptic substances has led M. Le Bon to the following interesting conclusions, which we translate from the *Polytechnisches Notizblatt:*

1. The disinfecting power of an antiseptic is weaker the further the decomposition has advanced.

2. The most energetic of the disinfectants are permanganate of potash, chloride of lime acidulated with acetic acid, sulphate of iron, phenol (carbolic acid), and the glyceroborates of soda and potash.

3. There is no connection between the disinfectant power of an antiseptic and its effect upon microbes.

4. Neither is there any connection between the power which prevents decay from setting in and that which checks or stops it when it has once begun.

5. Antiseptic substances in general exert but a slight effect upon the bacteria; an exception is found in those substances, like corrosive sublimate, which are violent poisons.

6. The poisonous action of a decaying body has no relation to the poisonous qualities of the volatile alkaloids evolved from the decaying substance.

7. These volatile alkaloids, which form only during advanced stages of decay, are very violent poisons, resembling prussic acid and coniine in toxic effect, showing how injurious the air from graveyards may be under certain circumstances, even when there are few if any microbes present.

Working Low Grade Ores.

It is a conceded fact that the salvation of a large portion of the Western mining regions depends more on some means of economically working low grade ores already found, than on the discovery of new and rich mines. It is more particularly the case with the older regions of this State and Nevada that the low grade ores must be made marketable before any great era of prosperity will be again seen. In European countries, concentration is always resorted to, and the ore brought up to a certain standard before being treated; but here concentration has not become universal. In fact, it has been altogether too much neglected; but lately efforts have been successfully made in several localities, and the merits of concentration are gradually becoming recognized.

Of course, there are other things necessary also to make a low grade ore pay. There must be plenty of it; the locality must be readily accessible; means and charges of transportation must be favorable; economical management, and skill and knowledge on the part of superintendents and employes; and, moreover, the business must be conducted on business principles, without overcapitalization, extravagance, or carelessness. There is little doubt, as we are now progressing, that in ten years from now we will be surprised that intelligent persons conducted mining affairs as they are in most cases now carried on.

It may encourage many persons with low grade ore on hand to know that by the use of improved devices and appliances they have, in the Black Hills of Dakota, reduced the cost of mining to 89 cents per ton, and the cost of crushing to 45 cents. Perhaps some figures in this connection will interest miners generally. A statement from Superintendent McMasters shows the yield, together with the cost of mining and milling, at the different mines in the Black Hills. They embrace, as we understand it, the product of all the properties from the outset of their exploitation up to July 31, 1882, as understood:

Homestake M. Co. produced	$4,367,180 48
(Tons of ore milled, 684,733; average per ton, $6.37.)	
Highland M. Co. produced	1,175,632 45
(Tons of ore milled, 234,081; average per ton, $5.02.)	
Deadwood-Terra M. Co. produced	1,221,946 57
(Tons of ore milled, 249,329; average per ton, $4.90.)	
Deadwood M. Co. produced before consolidation of Deadwood-Terra M. Co	834,192 28
Golden-Terra M. Co. produced before consolidation of Deadwood-Terra M. Co	788.054 62
Giant and Old Abe M. Co. produced before consolidation with Homestake M. Co.	72,469 34
Father De Smet M. Co., from January 1, 1878, to August 1, 1882, produced	1,974,640 36
(Tons of ore milled, 343,394; average per ton, $5.74.)	
Total product	$10,434,116 10

In connection with the central enterprise of this group the following figures are significant:

Up to December 31, 1879, the gross bullion yield of the Homestake Co. was	$1,051,265 58
For January, 1880	78,569 65
For February, "	84,868 20
For March, "	90.159 23
For April, "	104,281 13
For May, "	118,463 31
For June, "	123,413 03
For July, "	128.768 96
For August, "	144,980 43
Total to September 1, 1880	$1,924,769 52

Thus we see a steadily increasing production, while Superintendent McMasters is able to show that the cost of mining has diminished from $1.98 down to 89 cents per ton, and the cost of milling from $1.59 down to 64 cents in the 80 stamp mill, and from $1.23 down to 45 cents in the 120 stamp mill. Further: "The average gross yield of ore to June, 1879, was $9.69 per ton. Since then it has been found of advantage to extract and mill all the rock between the walls of the veins. This has lowered the grade of the ore somewhat, but the gross amount milled has been increased in great proportion, while the cost of mining has been correspondingly reduced. The yield of the ore from September 1879, to February, 1880, varied from $4.25 to $5.60 per ton. Since that date it has been increased by the ore of higher grade extracted from the 100 foot level, and now averages $7.95 per ton."

From the dividend standpoint the showing is as follows:

DIVIDENDS PAID.

Homestake—47 dividends	$1,512,500
Father De Smet—21 dividends	540,000
Deadwood-Terra—20 dividends	740,000
Deadwood before consolidation	275,000
Terra before consolidation	75,000
Dividends of the group	$3,142,500
Total assessment	400,000

—*Mining and Scientific Press.*

A Human Storage Battery.

C. H. Hughes, M.D., editor of the *Alienist and Neurologist*, gives in the April number of that periodical the following:

In a recent number of the *Michigan Medical News*, Dr. S. C. Woodman has made the following singular statement. We append thereto Dr. Woodman's letter on the subject in reply to our (Dr. Hughes) inquiries:

"I have a singular phenomenon in the shape of a young man living here that I have studied with much interest, and I am satisfied that his peculiar power demonstrates that electricity is the nerve force beyond dispute. His name is Wm. Underwood, age 27 years, and his gift is that of generating fire through the medium of his breath, assisted by manipulations with his hands. He will take anybody's handkerchief and hold it to his mouth, rub it vigorously with his hands while breathing on it, and immediately it bursts into flames and burns until consumed. He will strip, and rinse out his mouth thoroughly, wash his hands, and submit to the most rigid examination to preclude the possibility of any humbug, and then by his breath blown upon any paper or cloth envelope it in flame. He will, when out gunning and without matches, desirous of a fire, lie down after collecting dry leaves, and by breathing on them start the fire, and then coolly take off his wet stockings and dry them. It is impossible to persuade him to do it more than twice a day, and the effort is attendant with the most extreme exhaustion. He will sink into a chair after doing it, and on one occasion, after he had a newspaper on fire, as I narrated, I placed my hand on his head and discovered his scalp to be violently twitching, as if under intense excitement. He will do it at any time, no matter where he is, under any circumstances, and I have repeatedly known of his sitting back from the dinner table, taking a swallow of water, and by blowing on his napkin at once set it on fire. He is ignorant, and says that he first discovered his strange power by inhaling and exhaling on a perfumed handkerchief that suddenly burned while in his hands. It is certainly no humbug, but what is it?"

PAW PAW, MICH., Dec. 20, 1882.

DEAR SIR: Yours in regard to Underwood at hand. The article referred to is no joke, but *strictly true*, as can be attested by any resident here, as he has been in the habit and indeed now will do it at any time for a small fee. It is a very singular thing, and in the light of it, although I might not be willing to take as a thesis that electricity is the nerve force, I would be glad to combat the negative. I am wholly unable to understand it unless as it now seems to me, he generates from his lungs or stomach gas, and then after filling the handkerchief with it sets the gas on fire by a spark of electricity, and this burns the paper or the cloth. Either of the editors of our local papers, the *True Northerner* or *Free Press*, will substantiate all.

Very respectfully,

S. C. WOODMAN.

To C. H. HUGHES, M.D.

The Chaldean Account of the Creation.

Prof. Charles B. Warring, of Poughkeepsie, read a paper before the New York Academy of Sciences, on Monday evening, March 26, entitled, "A Study of the Chaldean Account of Creation, as translated by Mr. George Smith and Profs. Sayce and Lenormant, and also of the Account by Berosus, in Reference to their Connection with the First Chapter of Genesis." Much has been said about the discovery of ancient Chaldean tables containing an account of the creation so similar to that found in Genesis as to indicate that Moses obtained the views therein given from the Chaldeans. Prof. Warring proceeded to read the inscriptions that have been deciphered, giving the translations of Mr. Smith, and comparing it with those of Prof. Sayce. These fragments; he showed, had in most cases not the slightest resemblance to the Mosaic account of creation, even when due allowance was made for errors and differences in interpretation. In the Chaldean records the moon is placed higher than the sun, and time is reckoned by months instead of days. In it, too, the gods were created instead of creating. The speaker considered these Chaldean myths as a kind of *theogony* instead of a *geogony*.

The subject was discussed at some length by Prof. Martin and others. President Newberry spoke of the remarkable agreement of recent scientific discoveries and theories, especially in geology, with the account of the creation as described in Genesis. The statement that the earth was without form and void was a substantiation of the nebular hypothesis. Either the undulatory or corpuscular theory of light substantiates the statements therein made in regard to the existence of light before the sun and moon were created. The gathering of the waters together to form seas, and of the dry land to form continents, was confirmed by the geological record. In fact, the description of creation could scarcely have been given more correctly in so few words, considering that the object and intent of the description was not for scientific purposes, but for general information.

Trap Ventilation.

The withdrawal of the suit of Mr. John McCloskey against Mr. James H. Young, of this city, for infringement of a patent for the ventilation of traps in sewer connections (No. 218,891, dated August 26, 1879) is a substantial admission of the invalidity of the McCloskey patent, and of the common right of builders to use ventilating pipes in connection with such traps.

The evidence submitted conclusively showed that the device patented by McCloskey had been in actual use in this country for more than two years prior to the date of the patent.

The *Sanitary Engineer* for January 18 contains a full report of the evidence proving such two years' prior use, with diagrams showing the application of trap ventilation to houses built in Brookline and Boston, Mass., as early as 1876; and to the Palace Hotel, San Francisco, previous to July, 1877. The same system was applied at the same time and earlier to certain private dwellings in that city. There was evidence also that this important sanitary device had been in use in England for several years previous to the application of McCloskey for a patent for it.

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ENGINEERING INVENTIONS.

Mr. A. T. Schultz, of Zanesville, O., has patented a car coupling intended for the automatic coupling of the cars and the ready uncoupling of the same with perfect safety to the operator.

Mr. Henry Keller, of Corpus Christi, Tex., has patented an improved car coupling, the object of which is to provide a link of a peculiar construction, which automatically uncouples cars in case one or more of the cars run off the track.

Mr. John H. Blake, of Batavia, N. Y., has patented some improvements relating to rotary engines. These improvements pertain to the packing of the abutment and piston, to the method of adjusting the piston as it wears against the face of the cylinder, to a device for retaining the steam valve in place and for causing the abutments to move easily and noiselessly, and thus reduce the friction to a minimum.

An improvement in steam engines has been patented by Mr. John B. Shaffer, of Kearney, Neb. The invention consists in devices for avoiding dead centers in a compound engine. The cylinders are arranged one above the other, but not parallel. The low pressure cylinder is of double the length of stroke of the high pressure cylinder, and both are so connected with the rotary disk that when either one is at dead center the other one is at quarter-circle.

An improvement in removable partitions for stock cars is the subject of an invention by Mr. Watts Martin, of Pennsborough, W. Va. The invention consists of a detachable partition, which is fastened in place by a hinged joint on one side, which permits the partition to swing back like a gate, and for fastening the other edge when the partition is in place. The object of the detachable partition is to facilitate its easy removal without injury to the car.

An electric car brake is the subject of an invention for which letters patent have been granted to Mr. David J. Macpherson, of Sioux Falls, Dak. Ter. The invention consists in a magneto or dynamo electric machine placed on the locomotive and driven by steam furnished by the boiler, connection being made with electric motors under the cars, so arranged as to operate the brakes. By closing the circuit the brakes will be set, and by breaking the circuit the brakes will be released. In this way the brakes are entirely under the control of the engineer on the locomotive.

An improvement in car couplings has been patented by Mr. A. Wells Case, of South Manchester, Conn. The invention consists in drawheads provided with vertical slots, and with shoulders at the forward end of these slots to hold in engagement the crossheads of the swinging coupling bars. The coupling bars are mounted on hinging rods, to which are attached levers having chains attached to their free ends, so that the cars may be coupled or uncoupled from the roof of the car. The drawheads are supported from the frame of the car by links, the upper ends of which are hinged to the car frame, the lower ends passing around collars situated on both sides of the drawhead.

An invention designed to promote the durability of car axles and facilitate their repair has been patented by Messrs. Jeuleos Gamblee and John F. Haring, of Cresskill, N. J. The improvement consists of a car axle with its journal flattened on one side, and of separable bushings correspondingly flattened, whereby when these bushings become worn they may be readily removed and replaced by new ones. The bushings are prevented from turning on the axle by their flattened surface, and they are held upon the journals of the axle longitudinally by screws passing through the bushings and journals. The construction is very simple, and the use of the bushing is a great saving in the wear of car axles.

MECHANICAL INVENTIONS.

Mr. Frederick H. Dexter, of Wardsborough, Vt., has patented a novel mechanical movement, which is intended for transferring the driving power from one car to another of a train of cars, so as to utilize the traction of the different cars.

Dirt loading machine is the title given to a patent recently issued to Mr. J. J. Melville, of New York city. The machine is not confined in its use to the loading of dirt into carts, but is equally useful in harvesting potatoes and other root crops, they being scooped up and passed into a wagon over an endless apron, while the dirt falls to the ground.

An improved air compressor has been patented by Mr. W. A. P. Bicknell, of Riverdale, N. Y., which requires no adjustment for different degrees of compression, but is always self-acting, the valve closing rapidly when the piston reaches the end of the stroke, thus preventing any of the air finding its way back when the piston recedes.

Mr. G. H. Waring, of Indiantown, New Brunswick, Canada, has received a patent for a powerful but very simple machine for making spikes, bolts, rivets, etc. The dies, which are removable, fit in a revolving wheel, the hot metal being fed to the dies from the rear of the machine as the wheel revolves, performing its work in a most satisfactory manner.

Mr. Thomas Mayes, of Albany, N. Y., has received a patent for a wave power apparatus for the removal of sand bars and other accumulations from river or harbor beds. The machine is worked by means of a float which is put in motion by the action of the waves, and discharges, by aid of a pump, jets of water upon the accumulations with more or less force, loosening it so as to be carried off by the current.

Mr. John W. Brown, Jr., of Baltimore, Md., has patented some improvements upon a machine previously invented by the same party for cutting green corn from the cob. These changes consist in certain improvements in the construction of the knives, and of the manner of applying them to the slide, also in the construction of the plunger and plunger trough, and of the automatic feeding device for delivering the ears singly to the plunger.

A machine possessing the capability of both clothes washing and butter making is the subject of a patent recently granted to Mary J. Bridge, of Wimberly Mill, Texas. The specification asserts also that the same machine, when not in use for churning and washing, may be used as a sausage meat chopper, rice huller, and for various other purposes. Indeed, one seldom sees so simple a piece of mechanism put to so many different uses.

An improved washing machine, consisting of several arms or beaters attached to an axle, and suspended within the tub by an oscillating lever, is the subject of a patent granted a few weeks ago to Mr. A. Scheff, of Cleveland, O. The beaters are made to revolve by the swinging of the suspended lever back and forth over the soiled clothes, and by this double movement it is claimed that the clothes are thoroughly washed and but little worn by the operation.

A wire coiling machine, of that class in which the wire is passed around a spirally grooved former inclosed by a cylinder, has been patented by Mr. Edward W. Durkee, of Mason, Ill. The improvement consists in the combination with the wire feeding device and the former of a cap having the form of a segment of a hollow cylinder, which is securely fitted to the aforesaid former. Two wires may be coiled simultaneously by this machine, hence it does double the work of those ordinarily employed.

An improvement in furnaces for amalgamating metals has recently been patented by Mr. William E. Harris, of New York city. The furnace is supplied with several fire chambers, and the amalgamator, which is tubular, is placed horizontally within and near the top of the furnace. A revolving shaft with paddles attached extending through the amalgamating chamber keeps the quicksilver and pulverized ore constantly stirred, and a pump is employed to keep the amalgam constantly passing in contact with the quicksilver through the amalgamating chamber.

A novel method of winding clocks has been patented by Mr. Alfred Cupit, of Philadelphia, Pa. The invention is designed to provide means for winding clocks in such a manner that the springs will always be at full tension, thereby causing the clock to act always uniformly. This is accomplished by providing a mechanism to be operated by a lever which is connected with a door or some other object which is moved frequently. In this way the clock is always kept full wound, and the unequal action of the clock prevented. Devices which work automatically are likewise provided for preventing the overwinding of the clock.

A new and very ingenious machine for making sewing machine needles, has recently been patented by Mr. J. J. M. Chauvet, of New York city. The machine is composed of three different mechanisms—one for shaping the butt end of the needle and cutting off the wire, a second for tapering down the wire to form the needle, and a third for providing the needle with the side grooves—all the mechanisms being operated from one main longitudinal shaft. This needle making machine is very ingenious in construction, simple in its operation, and we should think likely to prove pecuniarily valuable to the patentee.

Mr. Oliver J. Mason, of Tallmadge, Ohio, has recently patented a novel machine for making clay smoking pipes. The machine consists essentially of an endless chain of pipe shaping moulds moving intermittently along and charged with the clay passing along where formers shape the bowl and perforate the stem of the pipes. Beyond the latter point the moulds open and discharge the pipes, and thence move back to the place to be recharged. By this ingenious machine the inventor alleges that a greater number of pipes can be moulded in a given time and at less cost than by any process before used.

Messrs. J. A. Hay and John Ralston, of Slippery Rock, Pa., have secured letters patent for an improved delivery roller for circular saw mills, the object of which is to enable the log to be supported a little in advance of the saw as well as in rear of the cutting edge, for sustaining the log against shifting by the thrust of the saw when it enters the end of the log. The roller also holds up the ends of the pieces cut off to prevent any changes of stress on the log at the moment when the separated pieces are detached, and thus enables the logs to be held more securely and the lumber to be delivered better than with the common delivery roller.

An automatic weighing apparatus for weighing any material that can flow in a stream from an orifice, such as grain, flour, liquids, etc., has been patented by Mr. George D. Hibbs, of Newark, N. J. The invention consists of a steelyard upon which is suspended a frame for holding a receptacle to receive the material to be weighed. The steelyard is provided with an arm, and when the long end of the yard is elevated by the weight of the material being weighed, the arm trips the toggle lever, which releases a vertical rod, thereby stopping the flow of material into the receptacle. The invention further comprises a device for attaching the bag or other receptacle to the frame of the steelyard.

An improved method of pressing hay and cotton has been patented by Mr. John A. Hampton, of Houston, Texas. The case of the machine, which is mounted on a truck, is provided with a follower which works backward and forward from the front end of the truck, and has a cover, the substances being pressed against a removable head at the other end of the truck, which is retained by a crossbar. The top, sides, and bottom of the case are furnished with retaining pawls, which hold the pressed bale, so that the follower may be withdrawn, in order that the case may be refilled while the pressed bale is being wired. The power is applied to the follower by a pinion wheel and toothed rack bar.

A novel fire escape has been patented by Mr. D. F. Black, of Brooklyn, N. Y. An extension ladder in three sections or more is mounted on a suitable truck upon pivots, so that when not in use it may assume a horizontal position. When the ladder is to be brought into use, it is thrown into a vertical position by an ingenious mechanism arranged for the purpose, and the sections are then elevated by means of windlasses and cables, and when raised to the proper height held in position by a pawl and ratchet combination which operates automatically. Bridges are pivoted to the upper portions of the sections, which may be swung up to the horizontal, to connect the ladders with the windows of the house. These are provided also with extension sections in case the bridges should not be long enough to reach the window as required.

An improved sugar mill, the object of which is to obtain greater durability and a more thorough maceration of the cane, has been patented by Mr. Christian D. Armstrong, of St. Bernard, La. Two pairs of rollers are placed in such relation to one another that the cane may readily pass from between one pair to the next, a fifth corrugated roller being located between these two pairs, which is driven by the frictional contact of the bagasse, performing the office of maceration upon the cane, and at the same time it conveys the cane mashed by the first set of rollers to the second set, thus obviating the necessity of a carrier between the two pairs of rollers. Perforated guide plates are arranged on each side of the middle roller between it and the two pairs of rollers, and these guides are kept moistened by a sprinkler suitably arranged above.

AGRICULTURAL INVENTIONS.

Mr. John William Jones, of Centropolis, Kan., has obtained a patent on a detachable point for cultivator plows, to enable new points to be applied when required. The invention also consists of an adjustable and detachable shovel connection with the plow stock.

A potato planter, claimed to be both a time and labor saving implement, has been patented by Mr. Thomas Lowe, of Wild Rose, Wis. This planter consists in a fork connected with the end of a staff for picking up the potatoes and a discharger for pushing them off in the ground, the latter being worked by a lever pivoted to the staff.

An adjustable holder for sickle bars of mowers and reapers has been patented by Mr. George W. Freeman, of Amherst, Nova Scotia. The invention consists in the combination with the finger bar and the sickle bar of sliding bolts having recesses in their heads for receiving and holding the sickle bar, and provided with springs to keep them in position, whereby the sickles will be made to operate with a drawcut.

Mr. Stephen H. Garst, of Greenville, O., has patented a sulky plow, which is so constructed that a tongue is dispensed with, whereby a great advantage is claimed to be had by relieving the plow from the strain which the tongue causes in turning at the end of the field, and at other times. By dispensing with the tongue the team is also relieved of considerable weight, and they are less hampered and are left free to move naturally.

A cultivator adapted to be used either on a side hill or the level ground, and so constructed that the teeth will enter the ground to a uniform depth, is the subject of a patent issued recently to Mr. Francis M. Allen, of Knoxville, Tenn. It is contended by the inventor that by his machine the corn will be less injured than by that kind of cultivators generally in use which work on a plane parallel with the surface of the ground.

An improved cotton chopper is among the latest inventions for southern planters which has been patented. Mr. Ephraim L. Mowrey, of Milton, Texas, is the inventor. The arrangement of the cotton chopper and the gearing for operating it, and the fender plates provided to prevent small plants from being injured by the soil, and limit the amount of soil left at the root of the plants, and at the same time to effectually cut the crust of the soil with the chopping hoe, without pulling the plants out of root, is the object of Mr. Mowrey's invention.

MISCELLANEOUS INVENTIONS.

Mr. Henry J. Frost, Jr., of Wooster, O., has patented a shaft loop, the frame of which is of metal faced inside with leather. A leather strap surrounds the metal loop, and is buckled to the belly band.

Mr. H. C. Reagan, of West Chester, Pa., has patented a car step which readily swings up out of the way when not in use, keeping it free from snow and ice in winter, and as it does not project from the car, it is safe from breakage.

Mr. William P. Husband, of Hartford, Conn., has patented an improved spinning ring, which consists in coating the ring with a vitrified material, whereby a smooth, glazed surface of extreme hardness and durability is obtained.

Mr. Benjamin Tryon, of Coxsackie, N. Y., has received a patent on an improved ice plow. The object of the invention is to lock the cutters at different points of adjustment and take the usual wear from the blades.

A convenient holder for gloves, bills, letters, etc., whereby one of the articles may be examined and withdrawn from the holder or file without disturbing the others, is the subject of a patent granted to Mr. E. A. Franklin, of Brenham, Texas.

Emily A. Stears, of Brooklyn, N. Y., has patented a culinary vessel for use on stoves and ranges for cooking various articles of food which is so constructed as to return to the fire by means of a flue all the gases and disagreeable odors arising from the cooking process.

Mr. L. D. Wright, of Carpentersville, Ill., has patented an improved clamp. This clamp consists of one of the jaws having pivotal connection with the bar, together with a lever extension on the opposite side of the bar, in which is an eccentric lever which swings and binds the jaw fast on the work.

A safety hammer for firearms has recently been patented by Mr. A. D. Hart, of North Garden, Va., which consists of a spring and cushion arranged inside of the hammer, which arrests the force of the blow if the hammer falls from less than the full cock, and prevents premature discharges.

Mr. W. H. Hackett, of New York city, has patented a novel and convenient cuff holder and sleeve button combined, which adjusts and holds the cuff in shape, and allows its being attached to or removed from the shirt sleeve much more readily than the method now generally in use.

An axle box having its inner end projected over the axle collar beyond the hub, and provided on its outer edge with one or more bevels, adapted to push mud from the axle bed and prevent its entering the axle box, is the subject of a patent recently issued to Mr. Robert Cartwright, of Rochester, N. Y.

A composition for suppositories has been patented by Mr. Anders Larsen, of Terrace, Utah Ter. This compound consists of tallow, camphor gum, alum, and bitter aloes of prescribed proportions, thoroughly intermixed. The composition is then poured into moulds of the desired form.

A improvement in a boot blacking apparatus has been patented by Mr. George Irving, Jr., of Bridgeport, Conn. The invention consists of a foot rest, mounted upon a horizontal swinging bar, to which is likewise attached device for holding the brushes and the blacking box.

Mr. Jacob Stoody, of Ripley, O., has patented a simple and convenient device to assist carriage makers in securing the leather upon the bows of top vehicles. Clamp hooks are employed to hold the bow in proper position for covering. The clamps are made adjustable to fit any size top by the use of thumb screws passing through slots in the top setter.

Messrs. L. E. Fuller and J. H. Macauley, of Chicago, Ill., have patented a sheet metal can designed to be used for packing and transporting liquid paints, preserved fruits, meats, etc. No solder is used in closing the top, which is accomplished by rolling over the marginal portions of the open end, forming a round, scroll-like triple seam.

A patent has been granted to Mr. William Wilmington, of Toledo, O., for an improved method of casting car wheels. The invention more particularly relates to the intermingling with the molten metal at the time of casting of certain substances which are alleged to produce a chemical effect upon the casting and improve the quality of the wheel.

A combined chimney ventilator and heater is the subject of an invention recently granted to Mr. Frank E. Ormsby, of Naumburg, N. Y. A ventilator and heater comprising an inner and an outer pipe, and provided with a register for establishing communication between the room and the air space, embrace the principal novelties in the above patent.

Mr. Andre S. Haynes, of Rome, N. Y., has received letters patent for an improved spokeshave. The invention consists of the application of bevel gauge stops to a spokeshave to serve for gauging the shave suitably for chamfering the corners of the work. The stops are adjustable for setting them to stop the shave at any required point, according to the angle it is desired to chamfer the work.

Mr. George C. Humphries, of New York city, has patented a crimp protector for preventing the uncrimping of ladies' frizzes. The protector is made preferably of mica having holes through it for thread or cord to pass through. To the thread the hair pins are attached which fasten into the frizzes, the mica plate resting on the forehead, which prevents the perspiration taking the crimp out of the front hair.

Mr. Mortimer D. Lawrence, of Marshalltown, Iowa, is the patentee of an improved carriage pole, which he claims will prove more substantial and durable than the ordinary pole, which is made of wood, and ironed or braced by iron. By the new invention the extension or socket is divided longitudinally, each section thereof forming an integral part of a half of the circle and of one of the side braces.

Pliers of an improved form for watchmakers and manufacturers of fine instruments of all kinds have been recently patented by Mr. Charles G. Schellenberger, of Terre Haute, Ind. Attached to the handles of the pliers is a punch for making holes in the main spring of watches. A recess is made in the inside of the jaws of the pliers for clasping the socket of watch hands, so that they may be readily expanded or contracted to fit the post.

An improved magic lantern, known as a wonder camera, has been patented by Mr. Edward B. Foote, Jr., of New York city. It consists in an ellipsoidal mirror having an aperture for the lens tube opposite the picture opening, whereby light can be reflected on the picture from all parts of the mirror, producing on the screen a large luminous view, more distinct in its lines than has been heretofore produced by other cameras.

A new beehive has been patented by Mr. Erasmus H. Key, of Mayfield, Ky. The invention consists in providing the hive with an inclined bottom, upon which rest the comb frames, made of beveled cleats. Provision is made for inserting a knife between the cover and the comb, to separate the two without injuring the comb. The invention further provides a device for inducing the bees to begin work in the center of the hive. Taken altogether, the improvements are calculated to facilitate the care of bees, and to improve their products.

A patent was recently issued to Mr. T. A. Harris, of Callisburg, Texas, on an improvement in store shelving, which it is intended to so construct that the goods will be free from damage by fire or water while being removed during a conflagration. The shelving frame is substantially built, and covered with tin or sheet iron to render it partially fireproof. The frame holding the section of shelves and their contents is mounted on castors, so as to be readily rolled from the building.

Messrs. Joseph Miller and Daniel Howarth, of Olean, N. Y., have recently obtained a patent on a steam boiler which is intended to be very durable and to generate steam with a minimum amount of fuel. To that end the inventor provides a water chamber at the back or bridge wall of the furnace, which is supplied with circulation tubes. These tubes extend into the fire-box and combustion chamber. A safe, inexpensive, and durable boiler of compact form, not liable to become injured by expansion and contraction, is thus constructed. It is to be observed that each tube is independent, so that each one is free to expand and contract, according to the heat it may receive, without affecting the others. A continual circulation of the water through the tubes will cause the sediment to fall to the bottom of the water chamber, where hand holes are provided for its removal.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Walrus Leather, Nickel Anodes, Turkey Emery, Pumice Stone and Composition. Greene, Tweed & Co., N.Y.

Straight Line Engine Co., Syracuse, N. Y. See p. 252.

Catalogues free.—Scientific Books, 100 pages; Electrical Books, 14 pages. E. & F. N. Spon, 44 Murray St., N. Y.

Owners of patents desiring to sell the same, or have the articles made on royalty, can address as below. Send full particulars. Cuts or papers returned if desired. Would be pleased to communicate with parties desiring bronze or brass castings. Lock Box 35, West Troy, N. Y.

New list Machinists' Tools now ready. Address E. West, Lockport, N. Y.

Storage of Electricity, $1; by N. Y. Agent College Electrical Engineering. Latest and best book on this subject.

Loud Speaking Telephones, $5 a pair. Illus. circular for stamp. Agents wanted. W. R. Brooks, Phelps, N. Y.

Improved Skinner Portable Engines. Erie, Pa.

American Fruit Drier. Free Pamphlet. See ad., p. 254.

Am. Twist Drill Co., Meredith, N. H., make Pat Chuck Jaws, Emery Wheels, Grinders, automatic Knife Grinders.

Drop Forgings. Billings & Spencer Co. See adv., p. 253.

Brass & Copper in sheets, wire & blanks. See ad. p. 252.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 254.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Combined Concentric and Eccentric Universal and Independent Jaw Chucks. The Pratt & Whitney Co., Hartford, Conn.

Catechism of the Locomotive, 625 pages, 250 engravings. Most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for catalogue of railroad books. The Railroad Gazette, 73 B'way, N.Y.

20,000 Duc Spherical Elevator Buckets, sizes 3½ to 17 inches, constantly on hand. Telegraphic orders filled. T. F. Rowland, sole manufacturer, Brooklyn, N. Y.

First Class Engine Lathes, 20 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Blake's Patent Belt Studs. Best & strongest fastening for Leather & Rubber Belts. Greene, Tweed & Co., N.Y.

Wanted.—Foreman for malleable iron foundry. One familiar with the running of air furnaces preferred. Address M. J. C., Letter Carrier No. 72, St. Louis, Mo.

The New System of Bee Keeping.—Every one who has a farm or garden can keep bees on my plan with good profit. *Illustrated circular of full particulars free.* Address Mrs. Lizzie E. Cotton, West Gorham, Maine.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 237.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 236.

See New American File Co.'s Advertisement, p. 238.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 237.

Steam Pumps. See adv. Smith, Vaile & Co., p. 236.

Boiler Scale.—Parties having fine specimens for sale or loan, address Jas. F. Hotchkiss, 84 John Street, N. Y.

Farley's Directories of the Metal Workers, Hardware Trade, and Mines of the United States. Price $3.00 each. Farley, Paul & Baker, 530 Market Street, Phila.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 221.

Lightning Screw Plates, Labor-saving Tools, p. 222.

The Best.—The Deuber Watch Case.

Curtis Pressure Regulator and Steam Trap. See p. 206.

The Celebrated Wooton Desk. See adv., page 206.

Permanent Exposition.—Inventors' Institute, Cooper Union, N.Y. City. Every facility for exhibition of machinery, merchandise, and inventions. The expense is small—the advantages great. Send for particulars.

Contracts taken to manuf. small goods in sheet or cast brass, steel, or iron. Estimates given on receipt of model. H. C. Goodrich, 66 to 72 Ogden Place, Chicago.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Lists 29, 30 & 31, describing 4,000 new and 2d-hand Machines, ready for distribution. State just what machines wanted. Forsaith & Co., Manchester, N. H., & N. Y. city.

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Magic lanterns, stereopticons, cond. lenses, etc., on hand and made to order, C. Beseler, 218 Centre St., N. Y.

Railway and Machine Shop Equipment.
Send for Monthly Machinery List
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25" Lathes of the best design. G. A. Ohl & Co., East Newark, N. J.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 84 John St., New York.

Engines, 10 to 50 horse power, complete, with governor. $250 to $550. Satisfaction guaranteed. More than seven hundred in use. For circular address Heald & Morris (Drawer 127), Baldwinsville, N. Y.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, New Haven. Conn.

Water purified for all purposes, from household supplies to those of largest cities, by the improved filters manufactured by the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 80 to 88 Market St., Chicago, Ill.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Ice Making Machines and Machines for Cooling Breweries, etc. Pictet Artificial Ice Co. (Limited), 142 Greenwich Street. P. O. Box 3083, New York city.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

NEW BOOKS AND PUBLICATIONS.

OFFICIAL ARMY REGISTER FOR JANUARY, 1883. 8vo, pamph., pp. 394. Washington.

HOW TO BUILD A HOUSE. New York: C. B. P. Association, 24 Beekman Street. Price 50 cents.

WEALTH CREATION. By Augustus Mongredien, with an introduction by Simon Sterne. Cassell, Petter, Galpin & Co., New York, London, and Paris. pp. 308.

A proper understanding of the causes which produce wealth is a great promoter in the production of wealth. This most recent work on political economy attempts to make this clear by defining what wealth is, and discussing the aids and obstacles to its creation. The author also shows that education and morality both promote and are promoted by the creation of wealth. The most valuable portion of the book is that in which he shows the expense and cost of wars and war preparations, while he points out how worse than useless they are. His method of settling international differences would be by arbitration. In the appendix he gives the draught of a constitution that he would like to see adopted by the great and small powers of Europe, forming a council that should settle all differences. He believes free trade to be a boon to a nation whether others adopt it or not, for an excess of imports is mostly a sign of wealth, and, strange as it may sound, he asserts that protection discourages native industry. Notwithstanding some of these absurd statements, the book is deserving of a careful reading.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) L. M.—The method of obtaining boron by electricity is not satisfactory, as it can only be obtained in minute quantities. It is preferably prepared by treating boric acid with an equal weight of potassium and igniting the two at a strong heat in an iron tube.

(2) G. W. H. asks: 1. Should fine oil paintings ever be varnished? I have one that has been varnished. Should anything be done to modify the effects of the varnish, such as oiling or anything else? If it does not hurt an oil painting to varnish it, what varnish should be used? A. Most oil paintings are varnished. Nothing is to be done to modify its effects. If it is in bad condition, revarnish it. Use the finest mastic varnish; it comes expressly for this purpose. 2. Does the gas that escapes from soft coal stoves injure oil paintings to a serious extent? A. Gas has an injurious effect upon paintings in a general sense, but in your case the injury possibly depends upon the amount of gas escaping, etc. We do not believe it would be serious. 3. What varnish is used over silver leaf to make it look like gold? A. Use gold lacquer. 4. Can a correct thermometer be made open at the top? A. Yes, but if opened the oxygen of the air would in course of time oxidize the mercury and so injure its utility. Of course alcohol would volatilize in the case of an alcohol thermometer.

(3) F. A. D.—Oleate of soda is formed by heating equal parts of soda and oleic acid with a small quantity of water; it forms a gelatinous mass which must be purified by dissolving it in alcohol. Probably pure Marseilles soap will answer your purpose.

(4) C. R. asks how much boracic acid to use for preserving one hundred pounds of fresh meat. A. About six pounds, and it should be injected.

(5) O. W. B.—Krewanek's analysis of the composition on Swedish matches of one variety is: glass, 1¼ parts; glue, 1 part; potassium bichromate ⅛ part; potassium chlorate, 6¾ parts; iron peroxide, ½ part; black manganese oxide, 2 parts; sulphur, 1 part. Jettel thinks that half the amount of sulphur would be enough. The friction surface contained: glue 1⅛ parts; manganese 4⅛ parts; antimony sulphide, 16⅜ parts; and amorphous phosphorus, 10 parts.

(6) U. W. writes: In the manufacture of harness leather, we occasionally have spots from which the lime has not been worked. What shall we use to rub upon such spots neutralize the lime, so the leather will take the blacking, as it is impossible to black such spots under ordinary treatment, while the remainder of the leather blacks perfectly? A. The spots may be treated with a little dilute muriatic acid and then washed.

(7) J. O.—For indelible pencils take of

Kaolin	8 parts.
Finely powdered manganese dioxide	2 "
Silver nitrate	3 "

Mix and knead intimately with 5 parts of distilled water, then dry the mass and inclose it in wood. Transfer paper is made by rubbing white paper with a composition of 2 ounces tallow; half an ounce powdered black lead; a quarter of a pint of linseed oil; and sufficient lampblack to make it of consistency of cream. These should be melted together and rubbed while hot on the paper. When dry, it will be fit for use.

(8) H. H. W.—Lead amalgam may be prepared by triturating lead filings with the mercury or introducing the mercury into the lead when it is in a melted condition. Care should be taken to not inhale the fumes of the mercury.

(9) R. N. A.—The method of making luminous paint given in the SUPPLEMENT 249 referred to is the correct one. Still, it is possible that you did not use the right kind of oyster shells; we understand that the manufacturers claim that a certain kind must be used. "Flowers of sulphur," is a term used in distinction to "roll sulphur." It is prepared by carrying the vapor of sulphur into a cool room, where it condenses and falls in the shape of dust or flowers. Sublimed sulphur is the same as the flowers of sulphur.

(10) T. G. C.—In mixing glycerine and litharge a paste is obtained which will harden in from ten to twenty minutes, depending upon the amount of litharge used. See also SUPPLEMENT No. 158 for receipts for cements.

(11) G. W. L.—Hydrochloric acid will dissolve shells. Use a very dilute bath and watch the action; if it is too strong, acetic or citric acid may be used.

(12) M. G. M.—As a general rule, a one-quarter inch area per horse power is given for steam pipes for high pressure engines, where the distance is not great, or under 50 feet. This quantity has to tally with the standard sizes of pipe, if of wrought iron. Therefore, when they do not exactly agree, use the next size larger, as you may judge by the distance you have to carry the steam. For engines of less than 15 horse power, a less area may be used for short connections, say one-fifth of an inch.

(13) J. W. W.—The plant received with your late communication is Lespedeza striata, *Hook and Arn (Japan clover)*. It belongs to the leguminous or pulse family of plants, the same as the clover, pea, bean, etc. How or from where it was introduced into the Southern States is not known. See *American Naturalist*, vol. i., page 495, also ii., 39.

(14) G. H. R.—For a celestial eye piece for power of 80 to 100, use a field lens 1¼ inch focus and an eye lens of three-eighths inch focus—seven-eighths inch face to face of lens—plane sides next the eye Huyghens' form, diaphragm in the middle or focus of eye lens. The terrestrial eye piece described in SUPPLEMENT No. 252 will give you a power of about 40 with your object glass. Make the tube 2 inches shorter than the focal length of the object glass, so that the Huyghens eye piece will fit the adjusting tube when shoved well in. The terrestrial eye pieces must also be fitted to the adjusting tube, so that you can bring it to the focal range by pulling the adjusting tube out a short distance.

(15) W. M. asks: 1. How many miles per hour will water run in a ditch or race with one-quarter of an inch fall per rod; said race being (we will say) 4 feet wide on top, 2 feet 6 inches on the bottom, and 3 feet deep, and conveying about 400 inches of water; said race having several moderate curves per mile? A. Making moderate allowance for friction of bends, 2·15 miles per hour. 2. How much fall should such a race have per rod, in a tolerably tenacious subsoil, so as not to cut the sides? A. About 8 inches per mile.

(16) W. A. H. asks: 1. In making a magnet (horseshoe) by putting each end in a helix, will it increase the magnetism to let it remain a greater length of time or not? A. Beyond the period required to saturate the magnet, nothing is gained by prolonging the operation. A magnet can be fully charged almost instantaneously. 2. Will it be better to have the magnet made of a flat bar of steel, or a square one? I think that in a magnet made of a flat bar there will be more lines of force in proportion, from pole to pole, to act on the helix to be placed between them. A. Within reasonable limits the form of the bar makes very little difference. Probably the square form is best. 3. Will it give more power to make the helix of No. 33 gauge wire for a small machine, or should the wire be smaller? A. Finer wire would yield better results. Use No. 36. 4. In regard to the commutators, would it not be best to have the wire from each end of the helix join on to a collar at each end? A. You can arrange them in that way for alternating currents. For description of electric motor, see SUPPLEMENT No. 259.

(17) D. M. L. asks: 1. What is used for making paper labels adhere to tin? A. Starch paste to which a little Venice turpentine had been added while it was warm, answers very well. The following is good: Soften good glue in water, then boil it with strong vinegar, and thicken the liquid, during boiling, with a fine wheat flour, so that a paste results.

(18) J. S. R.—The following receipts are used to remove odorous compounds from porcelain and glassware, and might be found efficacious for your purpose. Wash the articles with ground mustard and some water. A. Hubner finds that ground flaxseed, almonds, and other oily seeds have the same effect.

(19) R. L.—Asbestos makes the most durable felting for cylinders. If you can get the crude asbestos, you can make a plastic material by crushing and mixing with one-tenth its weight of good clay; add enough water to work it, and plaster the cylinder. If you wish to use the pure asbestos felting, you may obtain it in sheets of dealers whose advertisements will be found in our advertising columns.

(20) J. T. S. writes: Noticing in your issue of March 10, among Notes and Queries, No. 1, J. F. asks: "What is the best cement, etc?" Please say to him that the very best cement in the world in his case is copper rivets. Drill through the pulley at regular intervals holes just as large as the rivets; drive from the outside and rivet inside. No cement however good will hold in this case, for the push of the belt will make the covering travel. There must be something to hold the belt positively. The leather covering should be first wet and drawn down tight as fast as the riveting progresses, and at the finish a square butt joint should be made. In the case of No. 2, I would drill through as before, and either countersink from inside and use wood screws or use tire bolts, in which case there would be no need of countersinking. When the lagging is being put on, glue the edges with good common glue. He will never be troubled with lagging coming off if put on in this way.

(21) A. W. asks: How hot can water be made with exhaust steam without a back pressure on engine? A. There is always some back pressure with a high pressure engine. It can be heated to 210° or 212° without more back pressure than is due to the atmosphere.

(22) W. M. K. asks: In increasing the speed of a well formed ship from say 15 to 18 knots per hour, what proportion of the increased resistance is due to skin friction? A. Frictional resistance varies with the model of the vessel, fairness of bottom, and smoothness of surface. For high speeds, for average proportions of model, etc., frictional resistance varies from 50 to 70 per cent of total resistance.

(23) M. B.—A pendulum for seconds in latitude 23° should be 9919·58 millimeters in length.

(24) W. H. P.—For your tin battery cells, dissolve shellac in alcohol, and add about a spoonful of turpentine to each quart of solution.

(25) A. W. B. asks: 1. How can I make a liquid that will burn with a red flame? Must be a liquid. A. Dissolve a lithium salt in alcohol, and it will burn red. 2. How can I give marbles or balls a gold or silver coating without plating them? A. Coat them with size and then cover them with bronze or gold powder.

(26) F. O. B.—For floor polish cut beeswax into small pieces or else grate it up. Add turpentine, allow the mixture to stand for twelve hours, then heat the mixture over the fire till it dissolves. Care must be taken not to heat the mixture too hot, and also the flame must not come too near, for explosive vapors are generated, which are liable to catch fire. Brushes specially manufactured are now in the market for polishing floors.

(27) H. G.—Railroad paint, are made by grinding the colors in a small portion of linseed oil, and the mixture is then thinned out with benzine; sometimes petroleum oils or resin oils are used.

(28) C. D. M. writes: 1. A friend and myself are building a small oscillating engine (2½ by 5 inches) for a launch 22 feet in length and 6 feet beam. Please inform me what length of piston rod you would recommend to get the greatest possible speed. A. Of length to give clearance from stuffing box bolts sufficient to screw up the gland when engine is running. 2. And what would that speed be with 60 pounds pressure? A. Speed not over six miles per hour, with a fair modeled boat. 3. What size boiler would we require? A. Should have about 48 feet heating surface.

(29) J. C. D. asks what kind of clay or mineral is used in the manufacture of aluminum. A. Decomposed feldspar or any common clay found anywhere and everywhere contains aluminum. Says an English authority in this connection: "The sources of aluminum are, therefore, boundless, and it lies at the doors of the richest and poorest members of society." It is the most common metal, with the exception of silicon, that there is.

(30) J. M. C. asks: Is there any preparation that will insure the adhesion of oil paint to copper plate so that it will not blister or peel off? A. The best cure for the difficulty would be proper treatment to begin with. Some of the necessary precautions to follow are that the copper should be thoroughly dried; no adhering moisture can be allowed to remain on the surface; also any extremes of temperature are to be avoided; the copper must not be cooled nor can be heated, and the paint must be allowed to thoroughly dry before the copper is used.

(31) I. P. S. asks how the beautiful blue finish is produced on brass instruments such as theodolites and transits. A. The steel gray or bluish tint upon instruments is made by dipping or washing with chloride of platinum solution, which is made by dissolving platinum in 2 parts muriatic (hydrochloric) acid, 1 part nitric acid, mixed; as much platinum as the quantity of acid you may wish to prepare will take up. Use platinum foil, put the whole in a glass bottle with wide mouth, cover loosely, and place in warm sand bath or any place where it will be as hot as boiling water for a few days, when it will be ready for use. As soon as the proper color is produced wash the articles in water. If the solution is not saturated, the brass will turn brown and rough.

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(32) E. R. M.—A good cement for joining glass tubes to metal caps or connections is the following:

Glue, best white	11 ounces.
White curd soap	1 "
Plaster of Paris	3¼ lb.
Water	½ gallon.

The glue is put to soak over night in just enough of the water to well cover it. In the morning (or when properly softened) it is dissolved together with the soap in the rest of the water previously heated to boiling. When a quantity of the cement is required, a sufficient quantity of the plaster of Paris is mixed up quickly with enough of the warm liquid to form a smooth thin paste. This paste must be used at once, as it soon sets or hardens. When hardened, it is impervious to coal oil.

(33) R. O. B. asks where to obtain information concerning galvanizing metal, desiring to make use of the best process for galvanizing roofing material. A. We know of no book treating specially on galvanizing or zincking of iron. If you wish to galvanize sheet iron work, dip in a bath of muriatic acid 1 part, water 4 parts, leave the work in long enough to break up the scale; clean with brushes or scrapers so that the surfaces shall be free from scale or dirt. Then dip in a fresh bath of muriatic acid and water, 1 to 4, with about 1 ounce sal ammoniac to the gallon of solution. Then dry quickly and thoroughly in a hot oven or on hot plates of iron, and dip in the zinc bath. Never dip if any moisture remains among laps or rivets, for an explosion will ensue. Heat the zinc so that it will have a clear, shining surface. Sprinkle a little powdered sal ammoniac upon the surface to clear it. Skim away the dross.

(34) J. A. asks: How is the preservation of little fish in our aquariums at home explained. They live without apparently receiving the least bit of food for years, been kept in water very limpid? I refer specially to gold fish. A. Gold fish are a species of carp. They are vegetable feeders, and appear to thrive on the microscopic growths in ordinary water.

(35) A. W. W. writes: 1. I have tried to make a type metal casting from a perfectly dry plaster of Paris mould, but invariably gases seem to generate or an ebullition is set up by other causes, by which the casting is spoiled. What is the trouble? A. Use only plaster enough to hold the mould together, mix it rather thin with sifted coal ashes and sand, vent the mould thoroughly, and dry at a high temperature. 2. If two permanent magnets (steel) of about equal powers were brought into contact so that their several poles, as of horseshoe magnets, were touching, and then one of the magnets were revolved, so that *opposite* and *like* poles were alternately brought into contact (*a*) What would be the result to the magnets; would one destroy the other? (*b*) What would be the result if one of said magnets should be much more powerful than the other? (*c*) What would be the result if the magnets were not allowed to come into contact or did not quite touch? A. The alternating of the poles of two permanent magnets tends to destroy their polarity. (*a*) Yes. (*b*) The weakest magnet would first be enfeebled. (*c*) They would last longer. 3. Do you know of any other flexible incombustible material except asbestos and mica? A. Mineral wool. 4. Asbestos is used to a certain extent for lamp wicks. Why is it not used more extensively? Is it because of an inherent quality, or expense or difficulty of preparation? A. It is too fragile.

(36) X. Y. Z.—1. For an ice box follow the plan and general principles given in the article, "Ice House and Refrigerator, SCIENTIFIC AMERICAN SUPPLEMENT No. 116, page 1851. 2. A good mucilage may be made by macerating 5 parts of good glue in 20 parts of water for five hours, adding 20 parts of rock candy and 3 parts of gum arabic.

(37) T. G. H. and others.—The subject of soap bubbles is discussed in great detail on page 2539 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, under title of Plateau's Films. The following, much easier to prepare, is recommended: 1 gramme dry Marseilles soap is dissolved in 100 grammes warm water; this is filtered, and to every 100 cubic centimeters of the solution 40 grammes white sugar is added.

(38) W. C. J. H.—The dead black on optical instruments is produced by dipping in a solution of chloride of platinum. To make this, take two parts hydrochloric acid, one part nitric acid, mix in a glass bottle and put in as much platinum foil as the acid will dissolve when placed in a warm sand bath, or to hasten the solution, heat to nearly the boiling point of the acids. Half an ounce nitric and one ounce hydrochloric acid will absorb about thirty grains platinum, but in order to neutralize the acid it is better to have a surplus of platinum. Dip the article or brush in the chloride.

(39) J. D. M. writes: In refining some silver I melted some chloride in a new crucible, and the crucible absorbed all of the silver. How can I recover the silver? Have tried crushing and digesting in nitric acid. A. Break the crucible and grind it into fine dust, then fill in a new crucible with borax intimately mixed with the powder, and fuse.

(40) A. S. B.—Mildew is removed from cotton by rubbing into the material a little soap or steeping in a little soda and then steeping in chloride of lime. The following is likewise recommended: rub or scrape a little yellow soap on the article, and then a little salt and starch on that. Rub all well on the article, and put in the sunshine.

(41) W.—You can purchase the magnesia already calcined, or else you can buy the magnesium carbonate and calcine it yourself. The former sells at $1.00 a pound, and the latter at 25 cents.

(42) S. A.—For galvanizing cast iron with zinc, first clean the castings thoroughly by immersing in a bath of 1 part muriatic acid, 2 parts water, for a few hours, wash thoroughly in hot water and scrub with brush and sand. Then dip in a solution of sal-ammoniac and water, half a pound to the gallon, hot. Dry quickly and dip in the zinc bath.

(43) W. S.—An ink that will not freeze: Aniline black, 1 drachm; rub with a mixture of concentrated hydrochloric acid, 1 drachm; pure alcohol, 10 ounces. The deep blue solution obtained is diluted with a hot solution of concentrated glycerine, 1½ drachms; in water, 4 ounces.

(44) G. A. L.—All metals expand by heat until they reach the melting point. The amount of expansion is the same whether heated by steam or fire. If heated by steam, the expansion is greater at high pressure because the temperature is higher.

(45) M. B. S.B.—There is no way to sharpen hack saws that is more practicable than with a three cornered or saw file. The great trouble is to know how to use the file. The saw should be put in a vise so that it will not chatter, or place the teeth as close to the jaws as possible and not let the file touch the jaws. Do not be in a hurry. Move the file across the saw slowly, or very slowly from point to shank, bearing hard; do not draw the file backwards. You will not fail to sharpen satisfactorily the hardest hack saw that is made.

(46) W.—Brass work that is so dirty by smoke and heat as not to be cleaned with oxalic acid should be thoroughly washed or scrubbed with soda, or potash water, or lye. Then dip in a mixture of equal parts of nitric acid, sulphuric acid, and water; or, if it cannot be conveniently dipped, make a swab of a small piece of woolen cloth upon the end of a stick and rub the solution over the dirty or smoky parts; leave the acid on for a minute and then wash clean and polish.

(47) J. H.—The best mixture for small patterns, that does not shrink in casting, is, 69 parts lead, 15½ parts antimony, 15½ parts bismuth by weight. A cheap kind for finished patterns can be made of 10 parts zinc, 1 part antimony, 1 part tin.

(48) J. M. A.—For serpents' eggs try the following: One grain of dry mercury sulphocyanide is mixed with one ounce gum tragacanth which has previously been soaked in hot water. When the gum is completely softened, it is transferred to a mortar and the mercury sulphocyanide (in fine powder) is mixed with it by aid of a little water, so as to turn out a somewhat dry pill mass. This is then formed and cut into pellets of the desired size, which are dried on glass.

(49) R. H. W. asks how to charge a lapidary saw of sheet iron with diamond dust. A. Mix the diamond dust with good olive oil or lard oil, with one-quarter best kerosene oil added to thin and make it spread freely. Use a small iron wire flattened a little at the end like a spatula; dip in the diamond dust, and hold against the edge of the wheel. It requires very little to do the work.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

S. P. S.—The sample is limestone coated with hydrated iron oxide, apparently of no value. An assay would cost $5.00.—R. H. H.—The sample is pyrite—iron sulphide; it may carry gold.—A. C. R.—Only one sample received, *i. e.*, the white substance, which is a decomposed feldspathic granite. Its principal constituents are silica, alumina, and traces of lime and soda.—W. W. S.—The sample is galenite in quartz gangue. Its chemical composition is lead sulphide. Its value depends on whether it contains silver. To determine this, an assay will be necessary.

COMMUNICATIONS RECEIVED.

On Anti-Extraction. By R. H.
On Drainage. By C. F. H.
On Naval Construction. By C. M. R.
On the Obelisk. By J. E.
On the Origin and Early Use of Rolls. By L. F. & M. Co.
On Floods. By G. M. B.
On Long Distance Telephoning. By R. L. G.
On Transmission of Power by Electricity. By A. B. De R.
On Signaling at Sea. By F. K.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 10, 1883,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

Advertising device. J. Wrightsman 275,450
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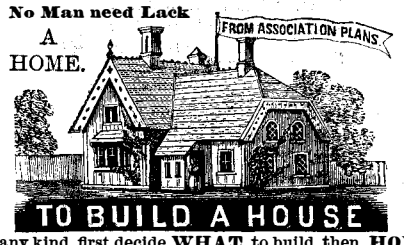

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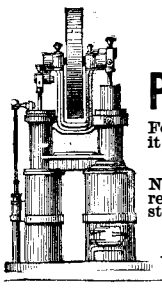
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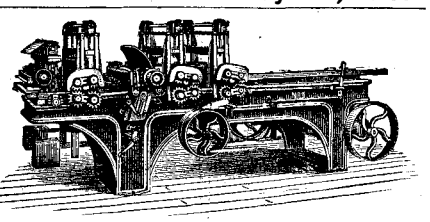
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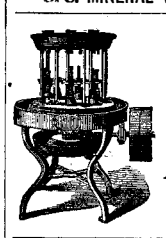
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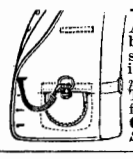

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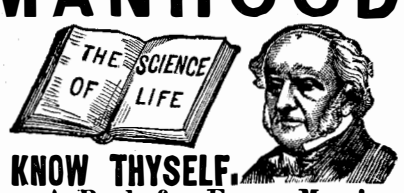

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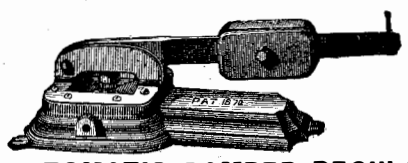

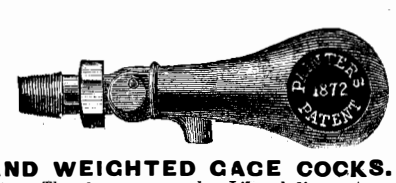

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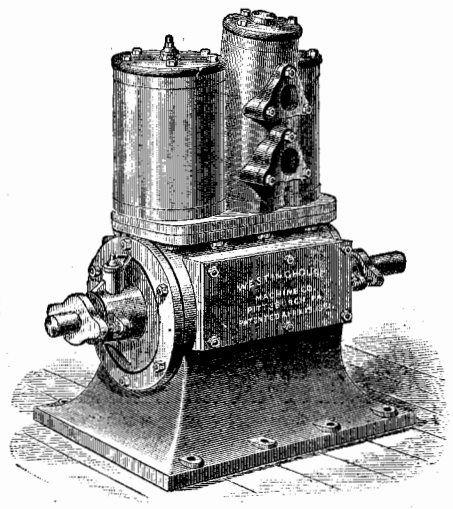

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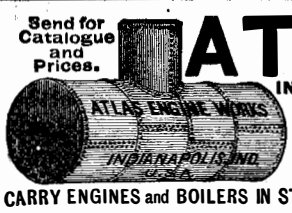

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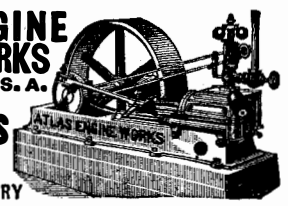

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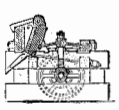

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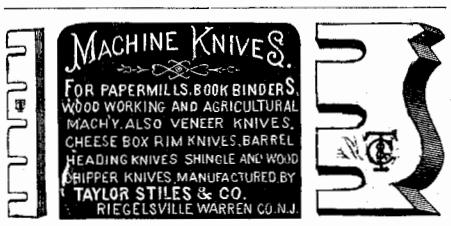
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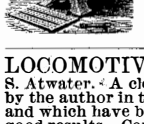

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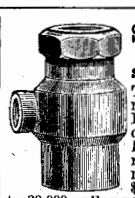

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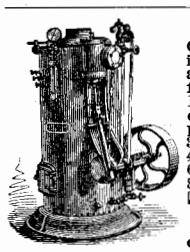

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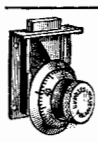

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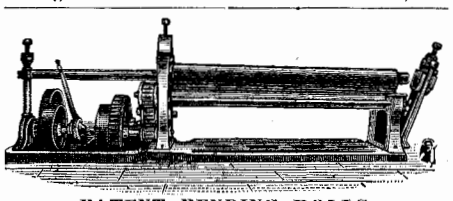

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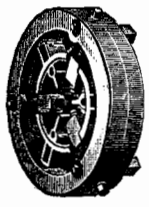

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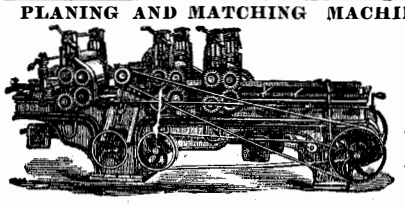

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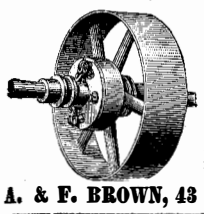

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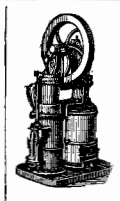

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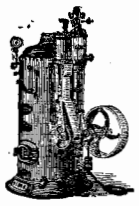

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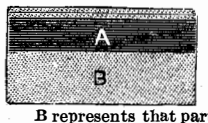

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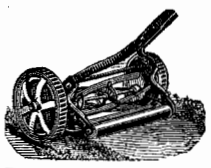

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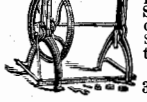

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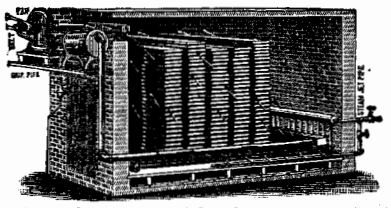

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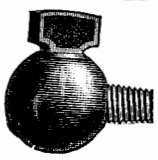

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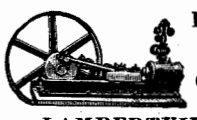

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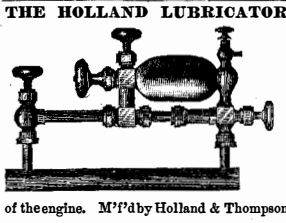

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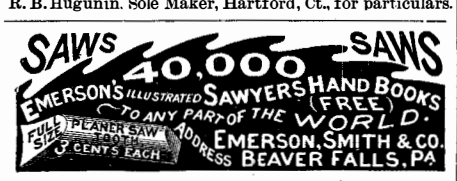

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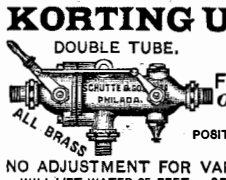

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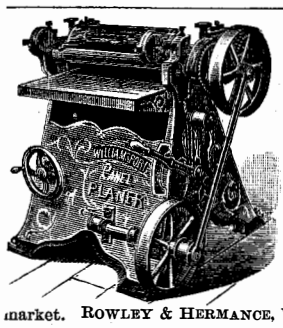

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